TECHNOLOGY DEPT.

ELECTRICAL REVIEW

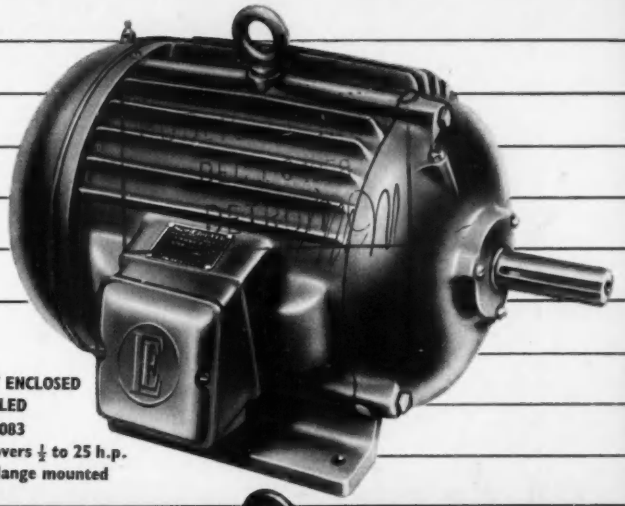
FRIDAY
NOVEMBER 1958

WEEKLY
PRICE 1s 6d

Further price reductions

for these ENGLISH ELECTRIC motors

New prices effective November, 1958



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FAN-COOLED
to B.S. 2083
Range covers ½ to 25 h.p.
foot or flange mounted

VENTILATED/DRIP-PROOF
to B.S. 2960
Range covers ½ to 50 h.p.
in 6 frame diameters

Thousands in use — hundreds in stock

'ENGLISH ELECTRIC'

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Industrial Motor Works, Bradford

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

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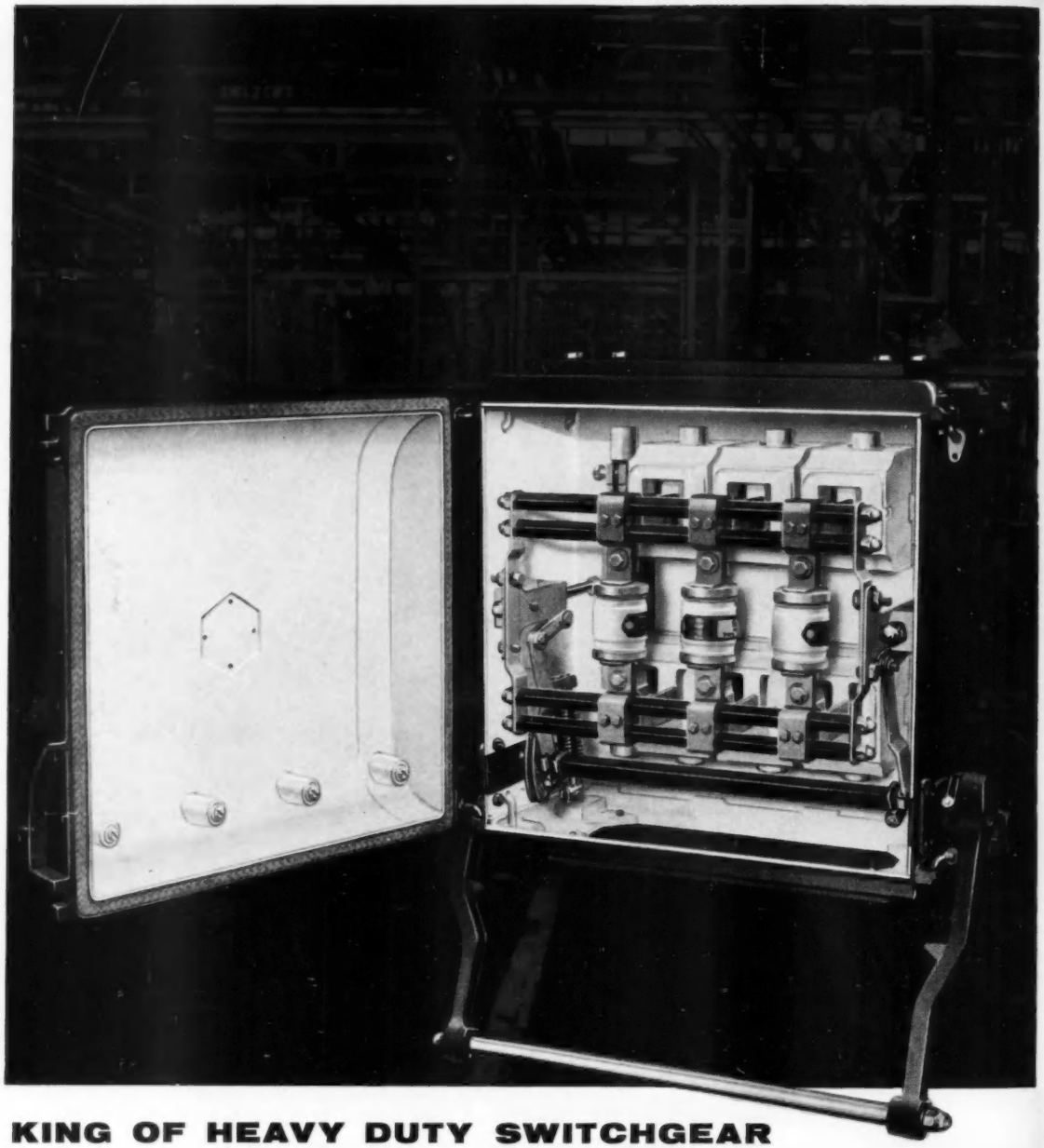

KING OF HEAVY DUTY SWITCHGEAR

MIDLAND ELECTRIC
MANUFACTURING
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TYSELEY
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MEM

MEM 'GLASGOW-REX' H.R.C.

THERE MUST BE few electrical engineers anywhere in the world who are not familiar with the "Glasgow-Rex" Switches and Fused Switches. The world-wide reputation gained by this range is well deserved. The quality is superlative.

Designed for heavy duty on large power and lighting installations "Glasgow-Rex" is available in ratings from 30 to 300 amps, 500 volts, in D.P., T.P., and T.P.N. patterns.

The fuse switches are fitted with "Kantark" H.R.C. Cartridge Fuse Links rated at the carrying capacity of the switch, and will clear the heaviest fault currents without risk of damage.

Bearing in mind that H.R.C. Cartridge Fuse Links are included, prices are most highly competitive.

Send for List No. 340 describing the "Glasgow-Rex" and other M.E.M. switchgear.

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Originators of Rectangular cistern type

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The F.B. (flat back) Cistern Type, Thermostatically controlled Electric Water Heater, is a complete hot water system in itself. It has its own ball valve feed, extension pipe and overflow connection. Available from stock in capacities up to 30 gallons. Larger sizes can be made to order.

The Heatrae F.B. Cistern Type is a pioneer Electric Water Heater. It occupies minimum space, has small projection and invariably gives satisfaction.

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The Natural Selection

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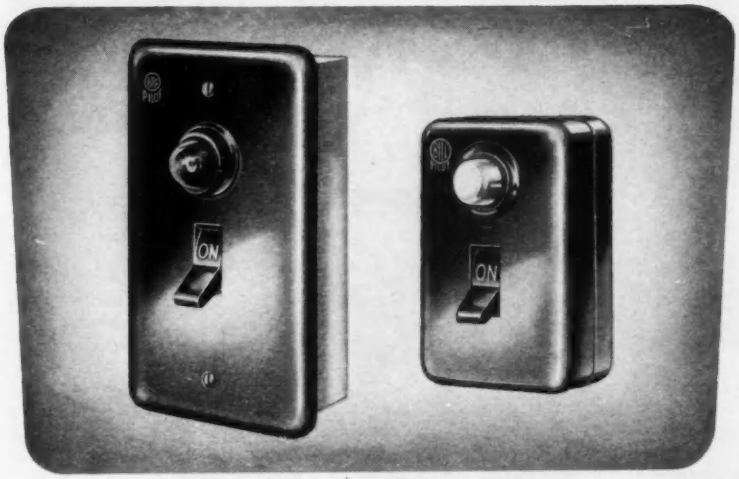
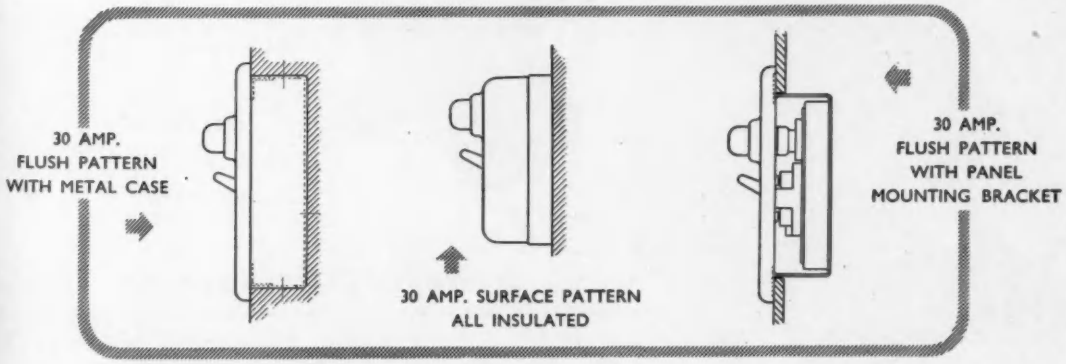
by **J. & G. COUGHTRIE Ltd.**

You cannot buy better gear

BILL PILOT SWITCHES



- IDEAL FOR WATER HEATING INSTALLATIONS UP TO 6 K.W. LOADING WHERE ON-LOAD INDICATION IS REQUIRED
- HIGH PERFORMANCE A.C. DOUBLE-POLE, SLOW BREAK SWITCHES WITH SILVER TIPPED CONTACTS
- TERMINALS ARE POSITIONED FOR EASY WIRING WITH FULL PROVISION FOR THROUGH EARTH CONNECTION



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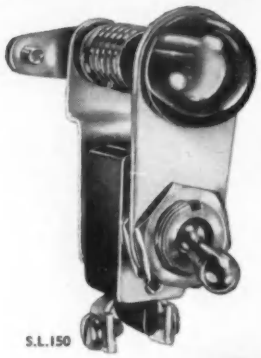
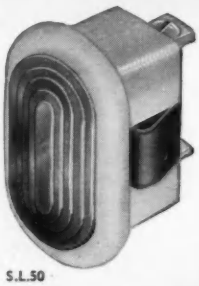
Arcolectric Signal Lamps

S.L.162

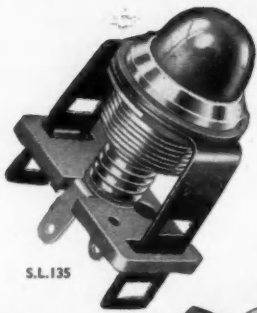
S.L.160

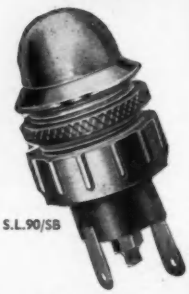

S.L.150


S.L.50

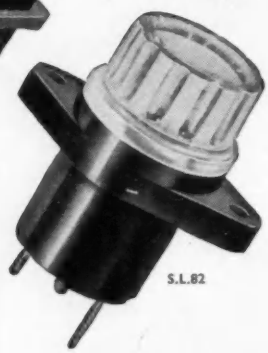
S.L.130

S.L.86


S.L.135


S.L.90/SB

S.L.100


S.L.82

Neon for 80—600 volts

S.L.162 and S.L.160 : New miniature low cost neon signal lamps. ½" hole fixing. Completely sealed against moisture.

S.L.50 : Snap-in fixing.

Low Voltage

S.L.130 : New high quality design for M.B.C. (M.C.C.) bulbs. Also available with M.B.C. neon.

S.L. 90/SB : Popular M.E.S. holder. Services No. 10AE/413.

S.L.135 : Adjustable M.E.S. holder.

S.L.150 : Combined toggle switch and M.E.S. signal lamp.

S.L.82 : M.E.S. holder ZA 4201.

S.L.86 : Low cost M.E.S. holder.

Mains

S.L.100 : For 15 watt. B.C. sign lamps.

A similar but smaller S.B.C. holder is available for S.B.C. 10 watt lamps.

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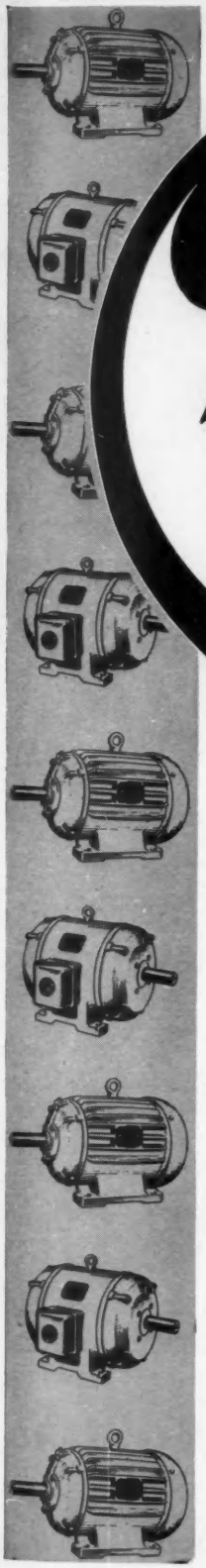

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BRITISH
STANDARD
DIMENSION
INDUCTION MOTORS

Ventilated or T.E.F.C.

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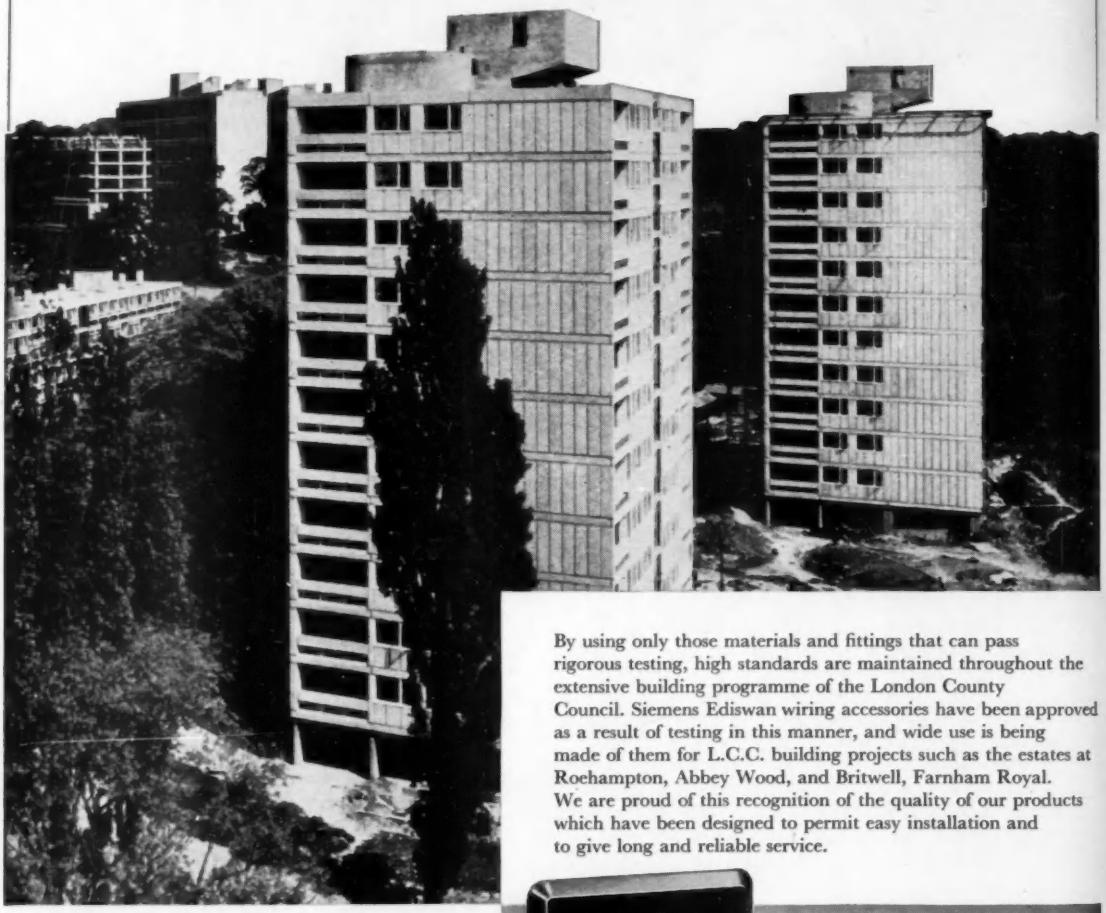
High standards...



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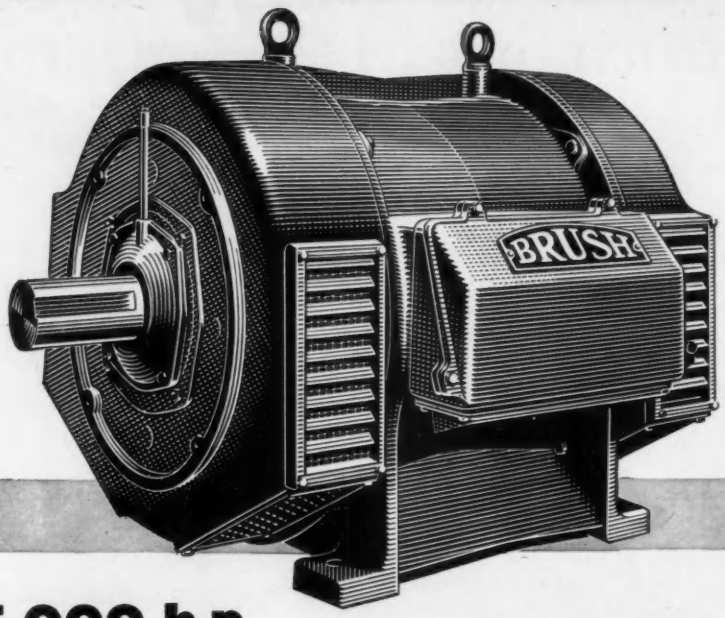
The logical choice in **ELECTRIC MOTORS**



Up to **5,000 h.p.**

Years of trouble-free service from Brush Electric Motors is proof of the practical wisdom and first class workmanship which distinguishes Brush products the world over. No better motors than Brush ever came out of any works.

To supply the power drive of industry, Brush offer a range of quality built AC motors with all types of enclosures and standard speeds, for horizontal or vertical mounting.

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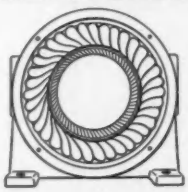
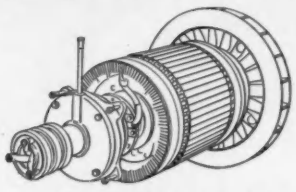
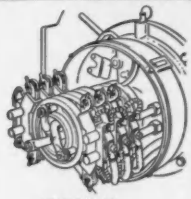
If you require motors within this range, just write to BRUSH stating your particular need —our technical engineers are at your service without obligation.



RIGID FRAME & WINDINGS



SLIPRING ROTOR ASSEMBLY



SLIPRING CONSTRUCTION

BRUSH — *for quality*

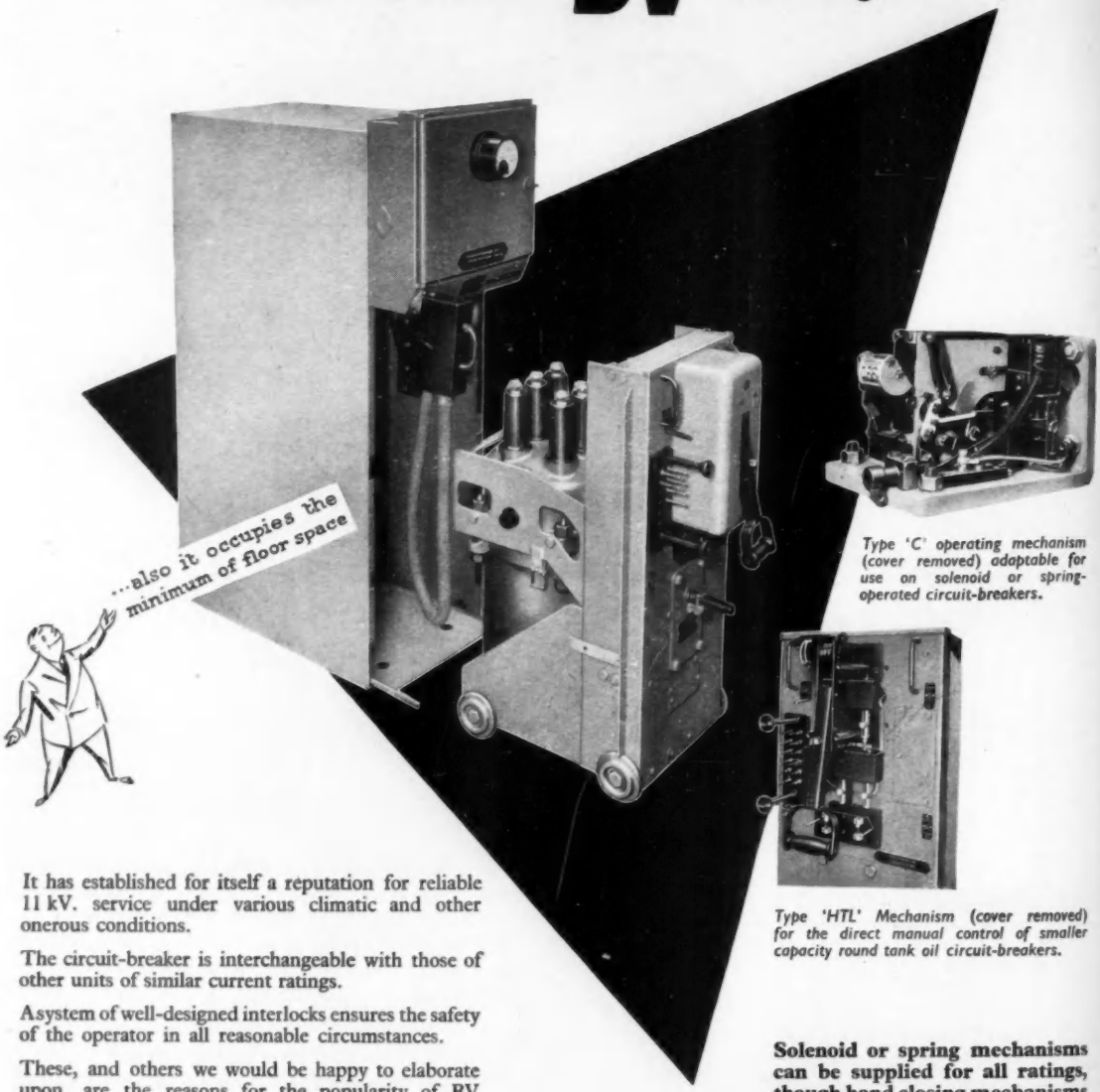
Literature G and stocklists available on application

BRUSH ELECTRICAL ENGINEERING CO. LTD.

Loughborough · England *Member of the Hawker Siddeley Group*

E.1

Reasons for the popularity of air insulated **BV** Switchgear



Type 'C' operating mechanism (cover removed) adaptable for use on solenoid or spring-operated circuit-breakers.

Type 'HTL' Mechanism (cover removed) for the direct manual control of smaller capacity round tank oil circuit-breakers.

It has established for itself a reputation for reliable 11 kV. service under various climatic and other onerous conditions.

The circuit-breaker is interchangeable with those of other units of similar current ratings.

A system of well-designed interlocks ensures the safety of the operator in all reasonable circumstances.

These, and others we would be happy to elaborate upon, are the reasons for the popularity of BV Switchgear, which may be found in service in all parts of the World.

Solenoid or spring mechanisms can be supplied for all ratings, though hand closing mechanisms are normally supplied up to a rating of 150 MVA.

NORMAL APPLICATION : Up to { **800 A** / **11 kV** / **75/250 MVA** } **SINGLE BUSBAR SYSTEMS**

Ferguson Pailin LIMITED *for Switchgear*

An A.E.I. Company

Head Office & Works: **HR. OPENSHAW MANCHESTER 11,** *Telephone* : DROylsden 1301 (Pte.Branch Ex)

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Automatic Self-Installation!

SAYS THE ELECTRICAL CONTRACTOR

Alas, he has us there! We *have* made our Keepalite equipment self-operating: the emergency switch is automatically tripped by mains interruption. We *have* made Keepalite largely self-maintaining: automatic trickle charging looks after the battery. But we haven't—as yet—got Keepalite trained to ease itself out of the delivery van, toddle down the basement steps, snuggle into its chosen corner and wire itself into the lighting circuits. Is there nothing we can do about this? There's plenty! We can—and do—lay on the advisory services of our electrical engineers to take any possible planning and costing headaches out of installation. Just ask—and the full service is yours, automatically!

Keepalite

AUTOMATIC EMERGENCY LIGHTING EQUIPMENT

For every purpose large or small

A PRODUCT OF CHLORIDE BATTERIES LIMITED

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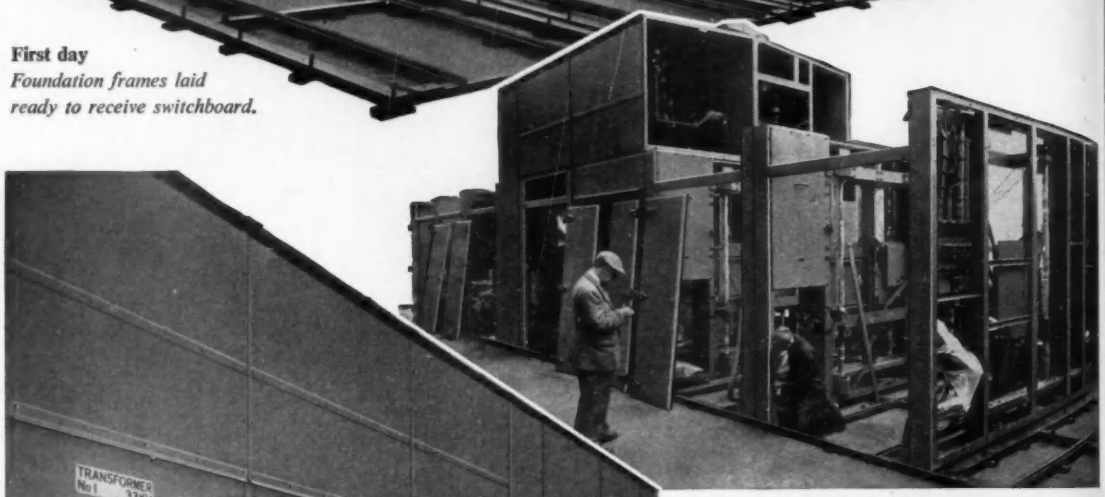
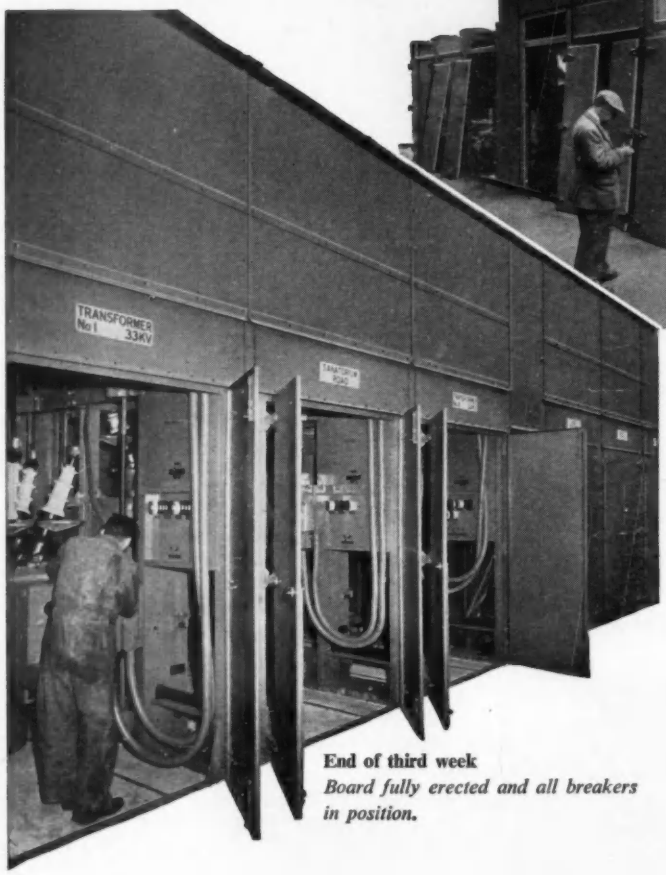
33 kV OUTDOOR AIR INSULATED SWITCHGEAR ERECTED IN 3 WEEKS

First day
Foundation frames laid ready to receive switchboard.



Third day *Showing sides, frames, and two of the busbar chambers in position.*



End of third week
Board fully erected and all breakers in position.

Shown here is a 7-panel, 33,000 volt air insulated, metalclad switchboard installed in the centre of a large industrial area in South Wales. It was completed ready for cabling in 3 weeks from the laying of foundation frames. The space required for this 7-panel board is only some 60 sq. yards compared with an equivalent conventional outdoor sub-station of some ten times this area.

S·W·S

SOUTH WALES SWITCHGEAR LTD.

BLACKWOOD · MONMOUTHSHIRE · Works at BLACKWOOD and TREFOREST.

SWITCHGEAR, SWITCHFUSEGEAR, TRANSFORMERS, CONTROL BOARDS

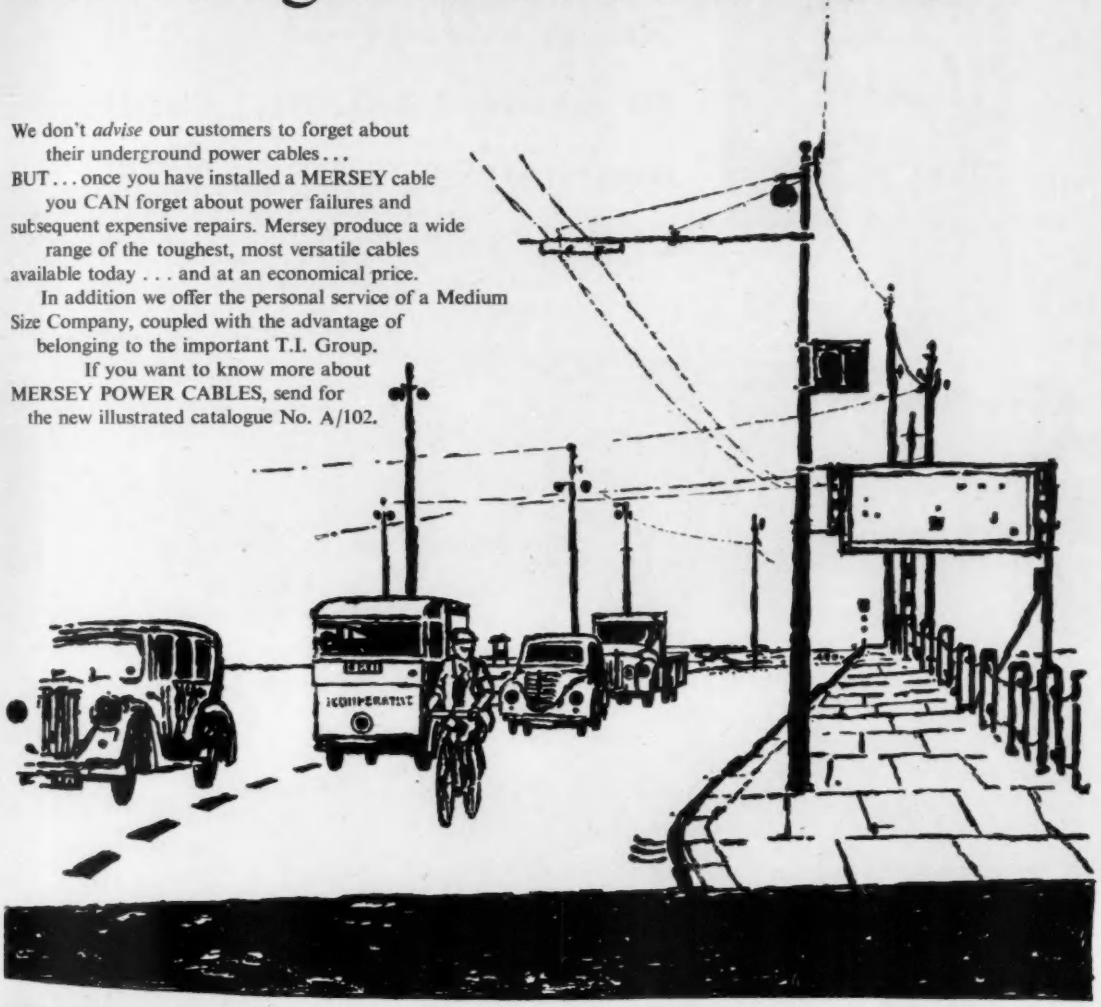
TGA 631

out of sight and out of mind

We don't *advise* our customers to forget about their underground power cables . . .
BUT . . . once you have installed a MERSEY cable you CAN forget about power failures and subsequent expensive repairs. Mersey produce a wide range of the toughest, most versatile cables available today . . . and at an economical price.

In addition we offer the personal service of a Medium Size Company, coupled with the advantage of belonging to the important T.I. Group.

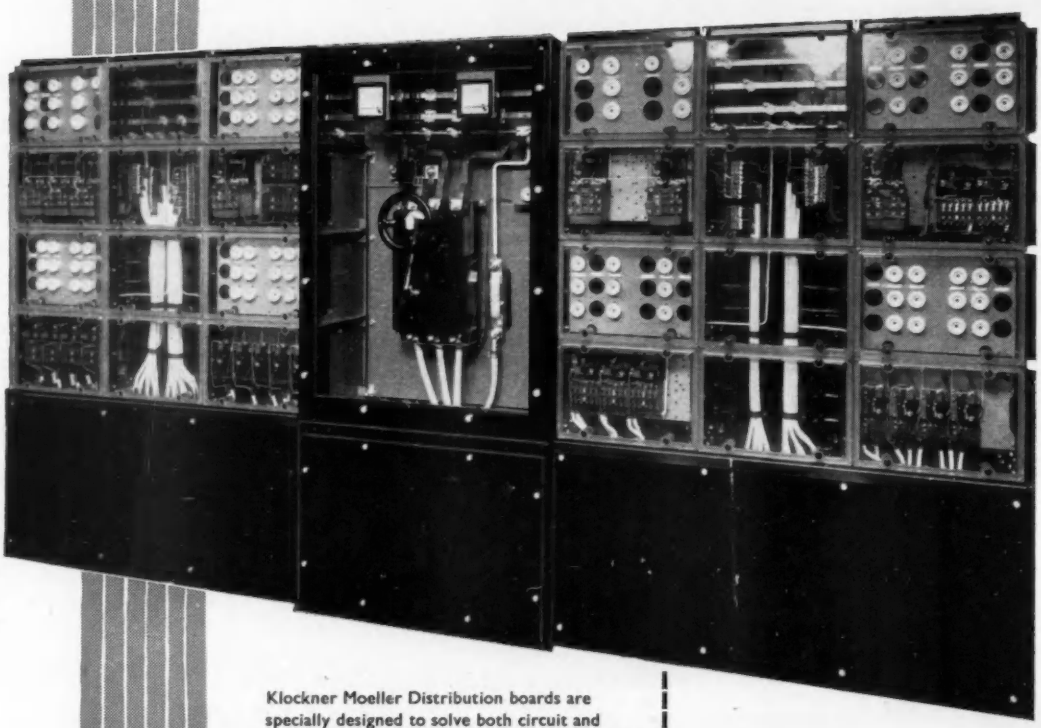
If you want to know more about MERSEY POWER CABLES, send for the new illustrated catalogue No. A/102.



MERSEY CABLE WORKS LTD • Liverpool 20 A TI COMPANY

MCW22

Ready wired—ready to connect I.D. Distribution boards now made in England



Klockner Moeller Distribution boards are specially designed to solve both circuit and space problems and are supplied with complete internal wiring ready for installation either completely assembled or with necessary units for assembly by the customer.
These boards are of unit construction incorporating proved Klockner Moeller gear and can be floor or wall mounted and installed in any location.
The use of standard units enables very competitive prices and favourable delivery to be made.

Fill in this coupon for illustrated literature.

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KLOCKNER MOELLER ENGLAND LTD.

Guaranteed-life control gear.

7 Charterhouse Buildings, Goswell Road, London, E.C.1.

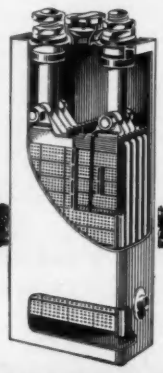
and at Manchester, Birmingham and Gateshead.

NDA 502

WHAT'S NEW ABOUT NIFE SWITCH TRIPPING UNITS?

The design is, for a start. The fascia panel, with its flush-fitting rectangular meters, is particularly clean and uncluttered. The inclusion of a high-rate charge indicating light is without precedent. Inspection of batteries has been simplified by putting them in *one* tier. The useful space at the bottom of the cabinet is just the place for tools. Finally, the cost is new. No, it isn't more but *less* than that of the former model. Now—

What's old about Nife Switch Tripping Units? Their reliability! Like the previous 12,500 models which are in service throughout the world, these new units are steelclad, self-contained and powered by the Nife steel battery. The battery that's free from self-discharge; the battery that won't corrode. The battery, in short, that *never* lets you down.

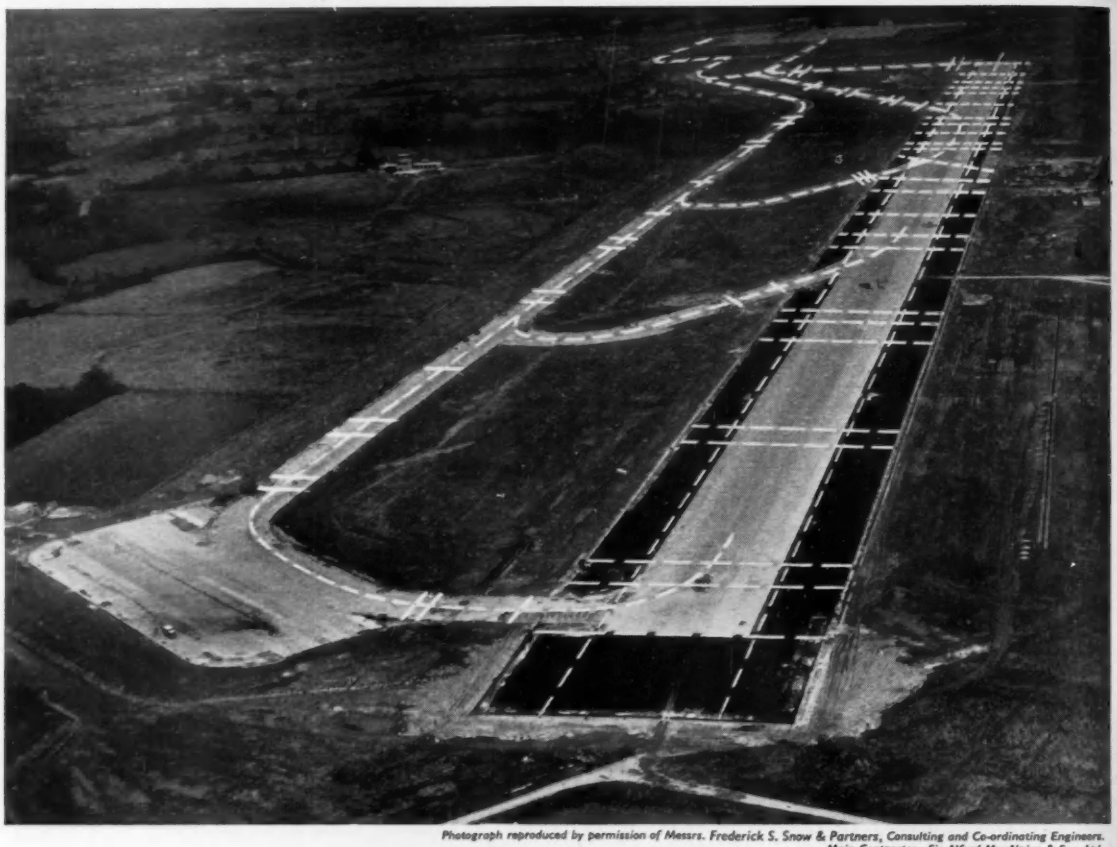


The Nife Switch Tripping Unit can be used, in addition, for any other application involving intermittent discharges. You'd like to know more about it?

Write for Publication No. 2751/A

NIFE BATTERIES · REDDITCH · WORCESTERSHIRE

N127



Photograph reproduced by permission of Messrs. Frederick S. Snow & Partners, Consulting and Co-ordinating Engineers. Main Contractor: Sir Alfred MacAlpine & Son, Ltd.

37 MILES OF KEY PITCH FIBRE CONDUIT FOR GATWICK AIRPORT

A 200,000 ft. installation of KEY Pitch Fibre conduit at Gatwick Airport has brought considerable economies and consequent gains in efficiency. Running under the runways as indicated on the photograph by broken white lines, the outstanding resilience of KEY is a major advantage. KEY is the ideal conduit for cable protection; joints are perfect and the surface is smooth; it takes up the smallest space, requires the minimum of concrete surround and is the quickest and cheapest to install. This modern conduit system is used for runway lighting, radar and communication cables, sub-station power cables and many other services throughout the Airport.

Easier and cheaper laying 'Tap-in' joints give faster, all-weather laying. On cost plus labour basis, KEY Pitch Fibre conduit is cheaper per installed foot run than any other conduit system.

No cracking through settlement KEY Pitch Fibre conduit is resilient and even though foundation movement may occur, fracture of the conduit is most unlikely.

Highly resilient in service Will withstand all the exacting conditions of cable service.

Smooth bore—low friction A coefficient of friction as low as 0.30 facilitates cable pulling.

Light and easy to handle Transport, storage and handling costs are greatly reduced.

Sizes and fittings The standard length of light wall conduit is 5 ft. 6 in. for internal diameters of 2 in., 3 in., 3½ in., 4 in., 5 in. and 6 in. Where required, however, 4 in. and 6 in. diameter conduit can be supplied in 8 ft. lengths. Curved conduit, in 3 ft., 6 ft. and 12 ft. bend radii, is available in all diameters.

Fully approved KEY Pitch Fibre conduit is used by principal and local Government authorities both in the U.K. and overseas.

Get to know more about **KEY** **PITCH FIBRE CONDUIT**

The world's finest conduit at lowest installed cost!

A product of **KEY ENGINEERING COMPANY LIMITED,** Larkfield, near Maidstone, Kent. Tel: Maidstone 7461 and 7233

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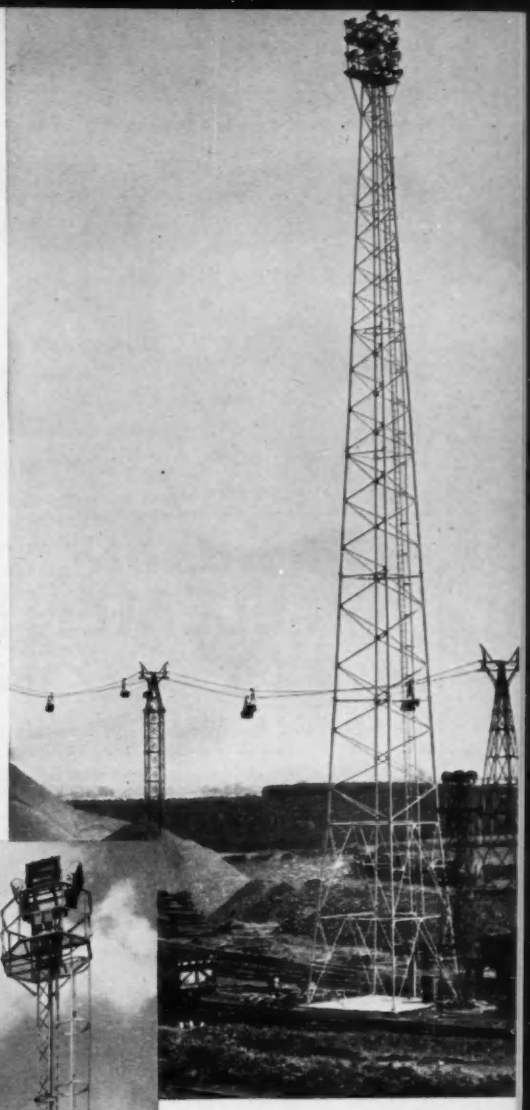
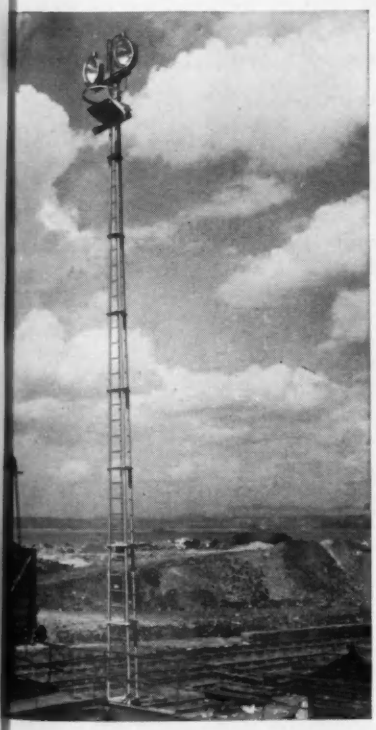
TGA KC1

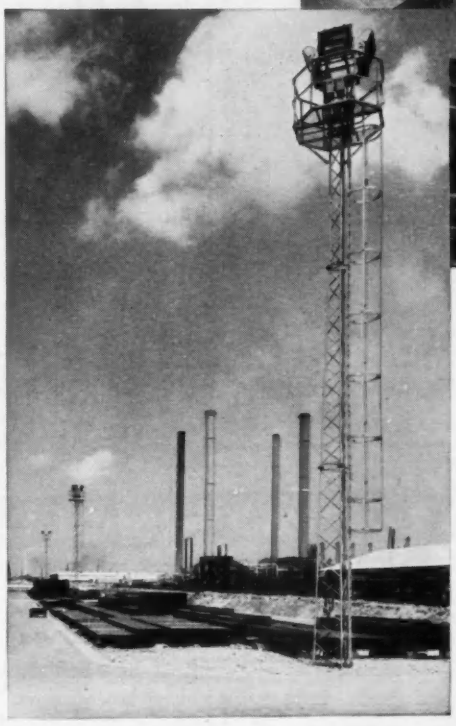
TUBEWRIGHTS STANDARD TUBULAR STEEL FLOODLIGHTING TOWERS

We have developed a range of standard floodlighting towers with a choice of headframe to meet the requirements of the modern lighting engineer.

In addition to our standard ranges, we manufacture towers for all purposes, examples being the 603 ft. high self-supporting radio mast at Gibraltar, and floodlighting towers for many sports installations, including those for Chelsea F.C. Steel tube has been proved ideal for tower construction.







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Left: Standard Type 30/60 Floodlighting Tower, 50 ft. high, at the Stanlow Refinery of the Shell Refining Co. Ltd., Ellesmere Port, Cheshire.

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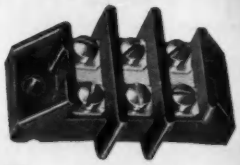

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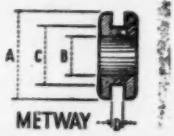

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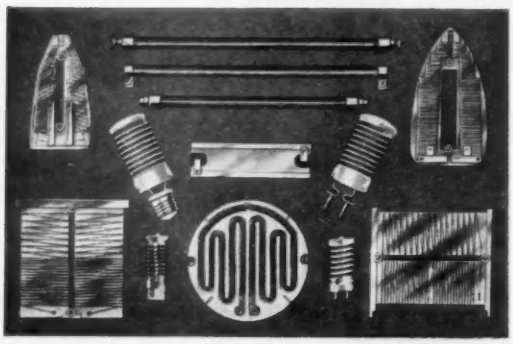

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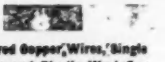

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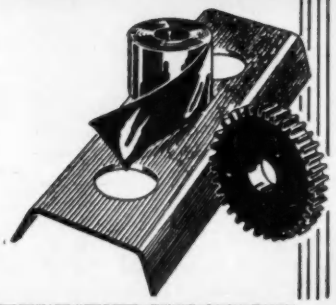

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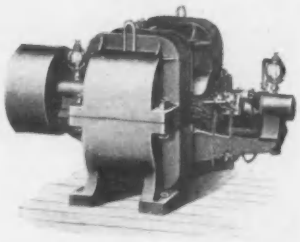

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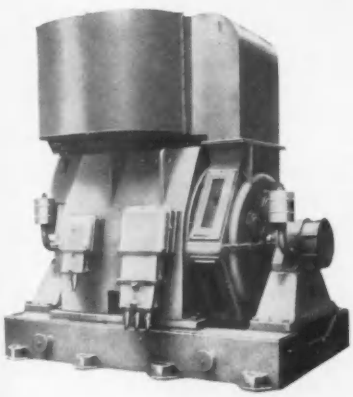

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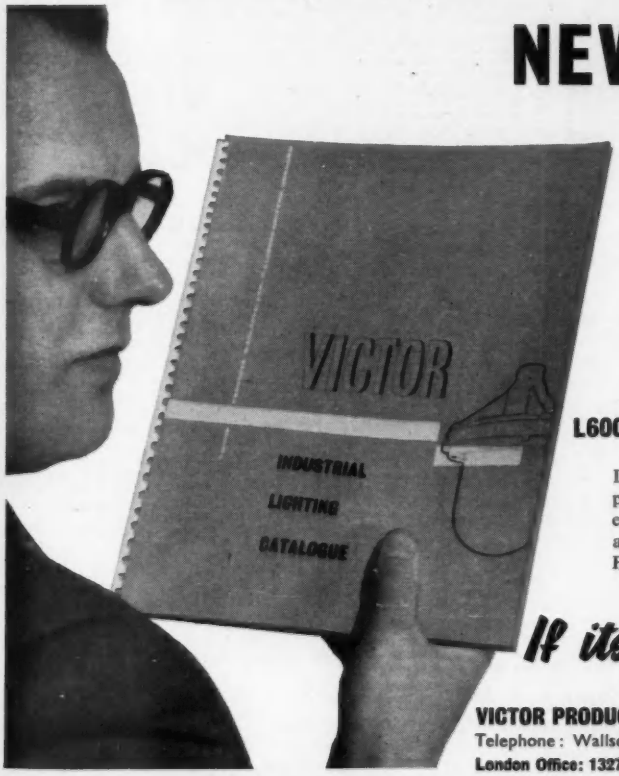

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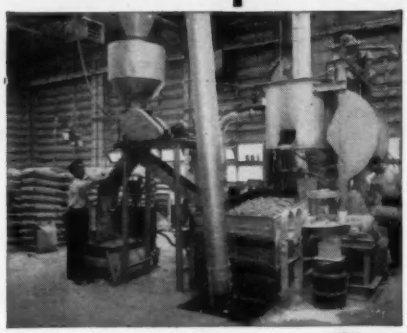

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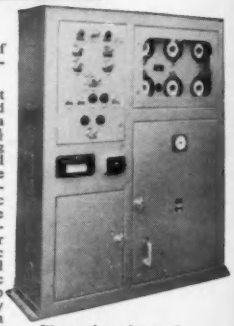

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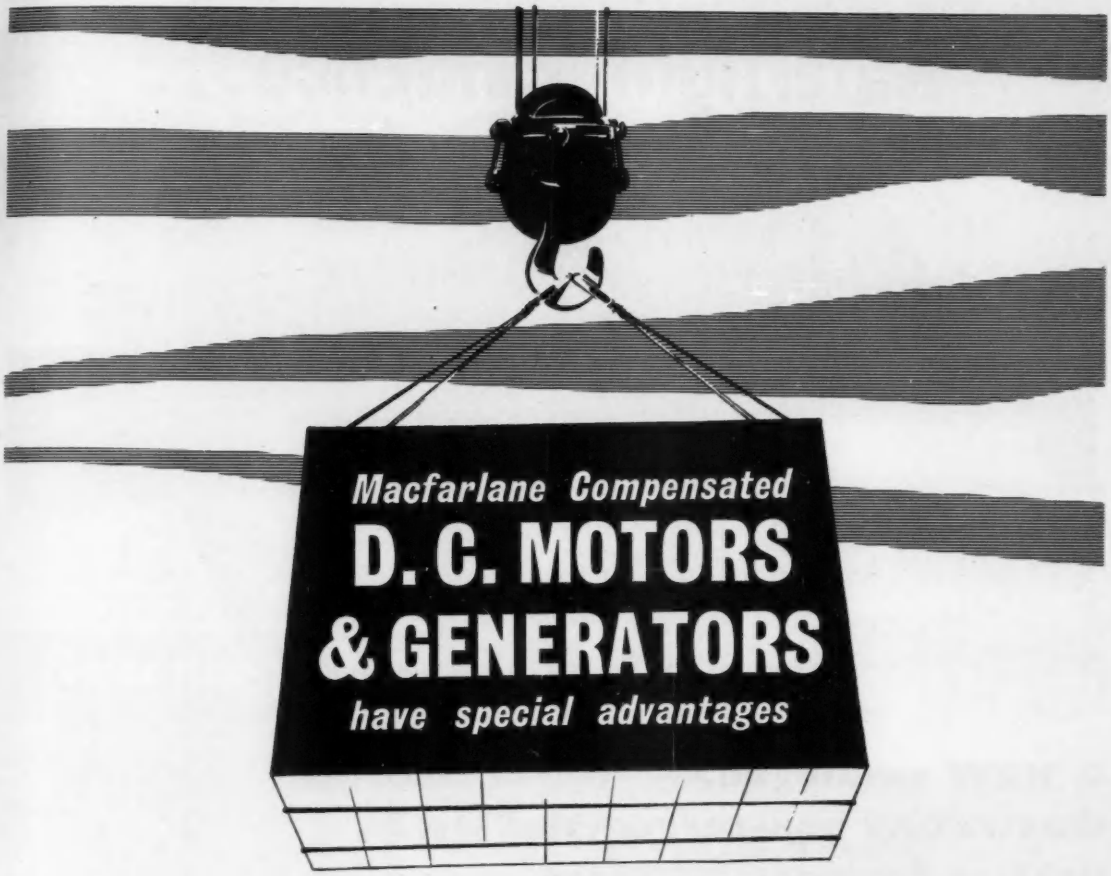

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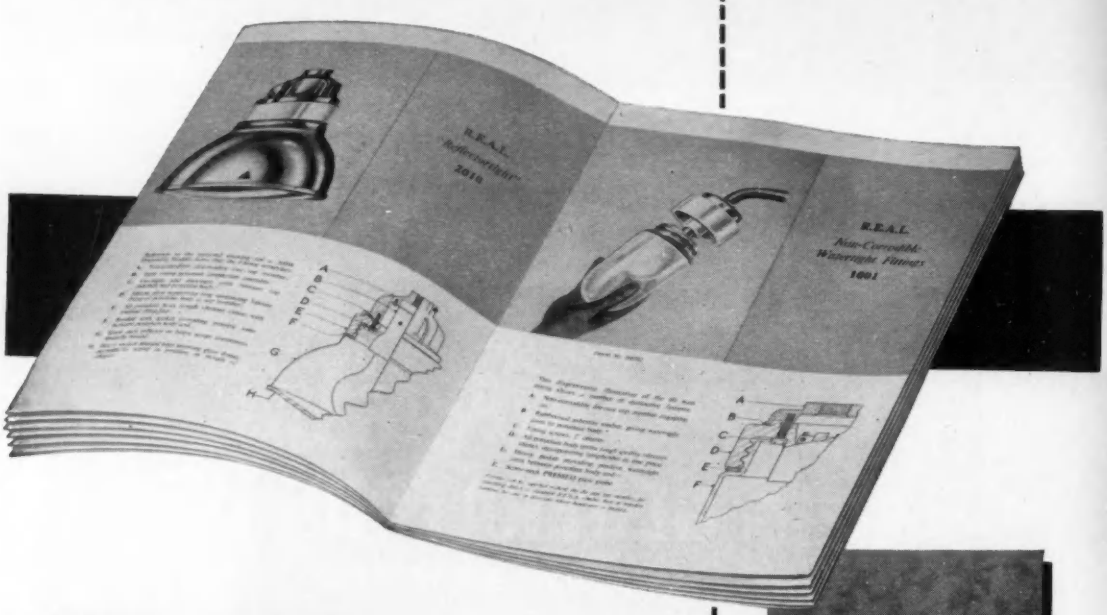

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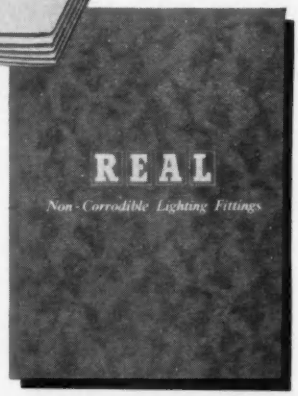

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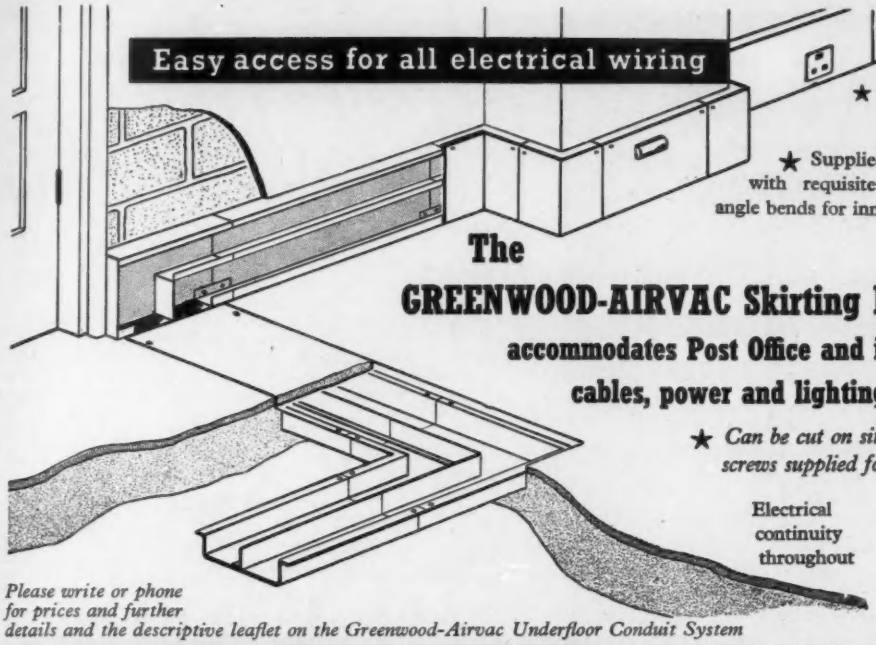

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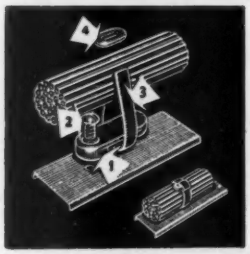

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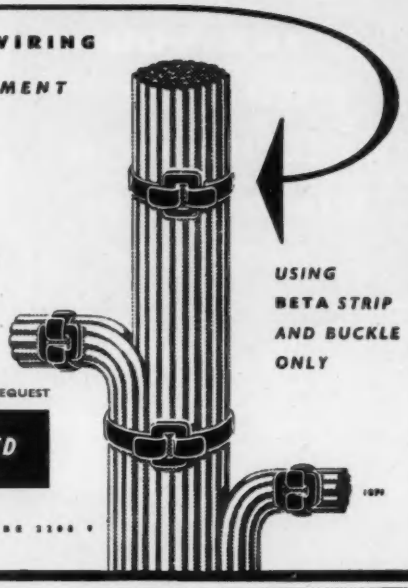

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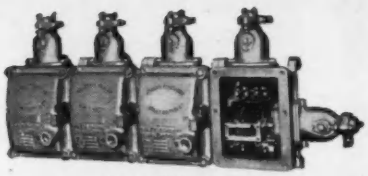

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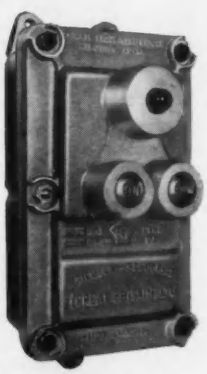

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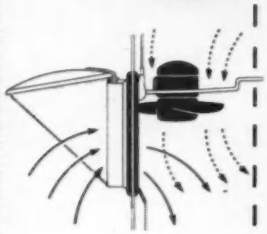

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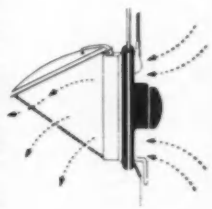
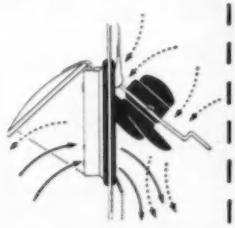


STALE AIR OUT



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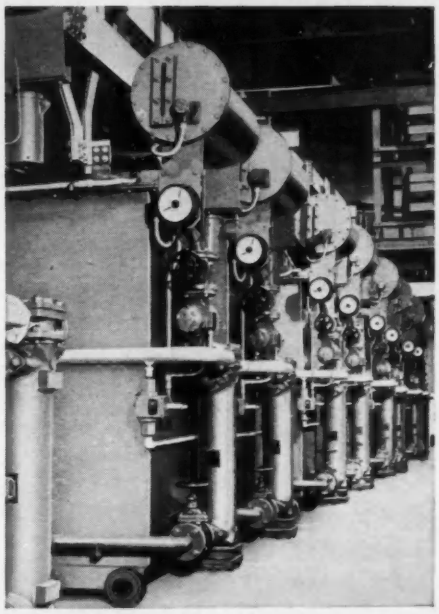

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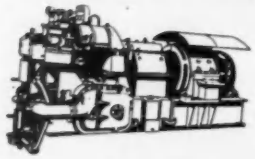

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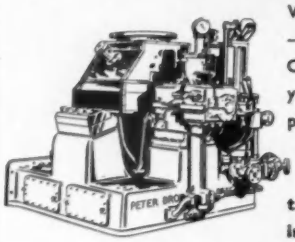

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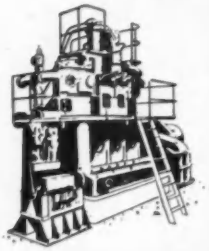

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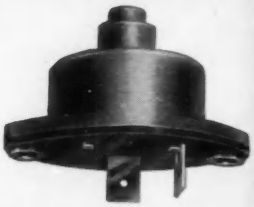

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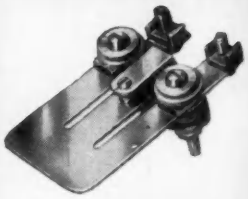

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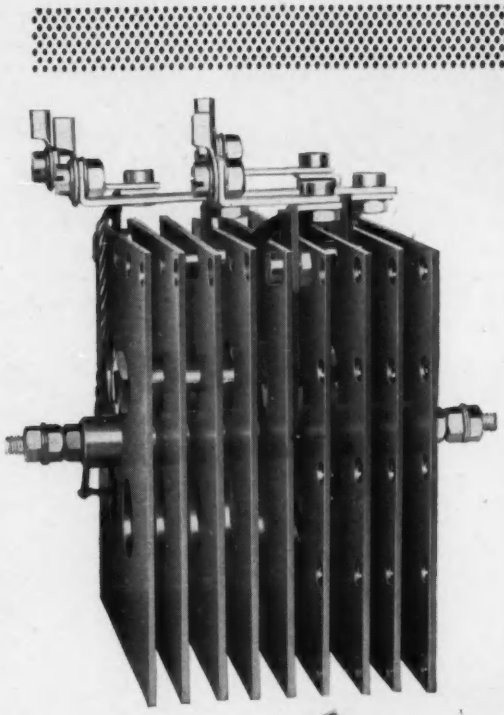

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SINGLE PHASE BRIDGE (4 Diodes)	19E3-1-1 19F3-1-1 19G3-1-1	56 42 28	49 37 24	40 40 40	£20. 0.0d £15.10.0d £10.15.0d
		Phase Line			
THREE PHASE HALF WAVE (3 Diodes)	19E4-1-1 19F4-1-1 19G4-1-1	32.4 56 24.3 42 16.2 28	37 28 18	56 56 56	£15. 0.0d £11.12.6d £ 8. 0.0d
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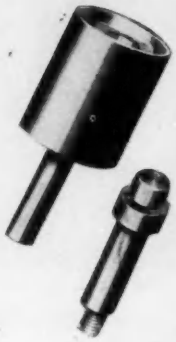

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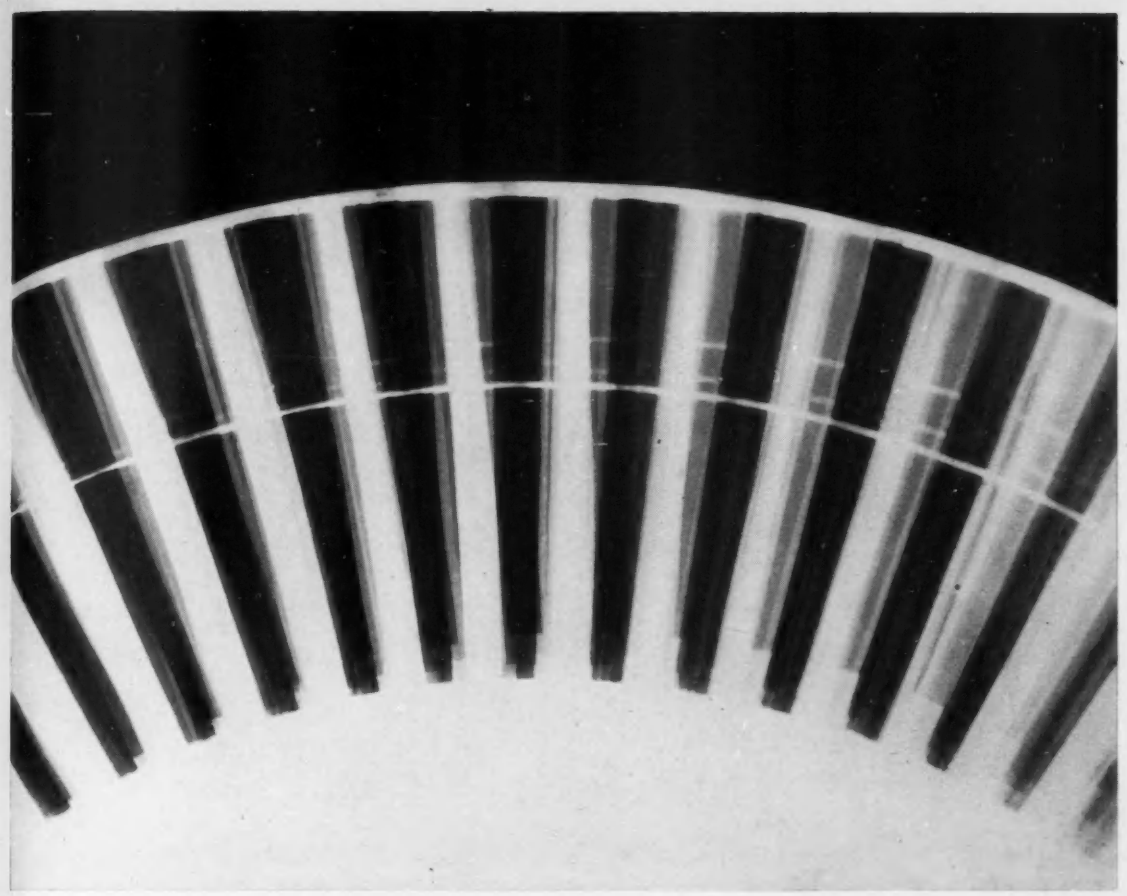

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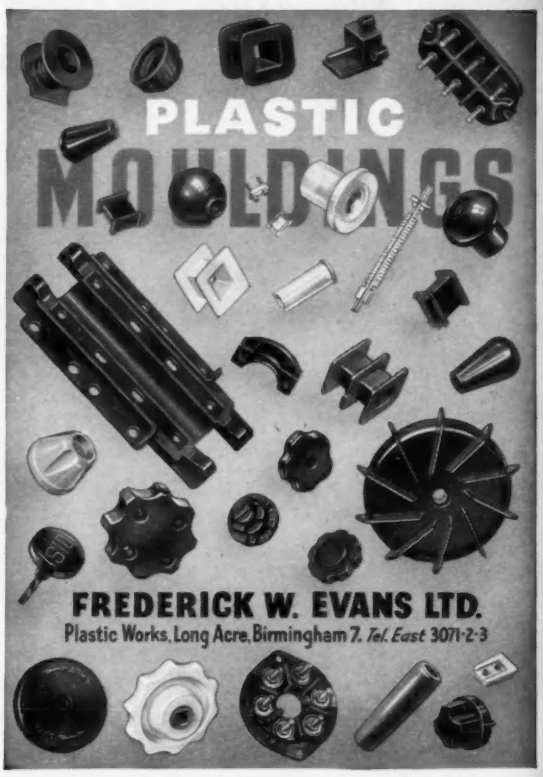

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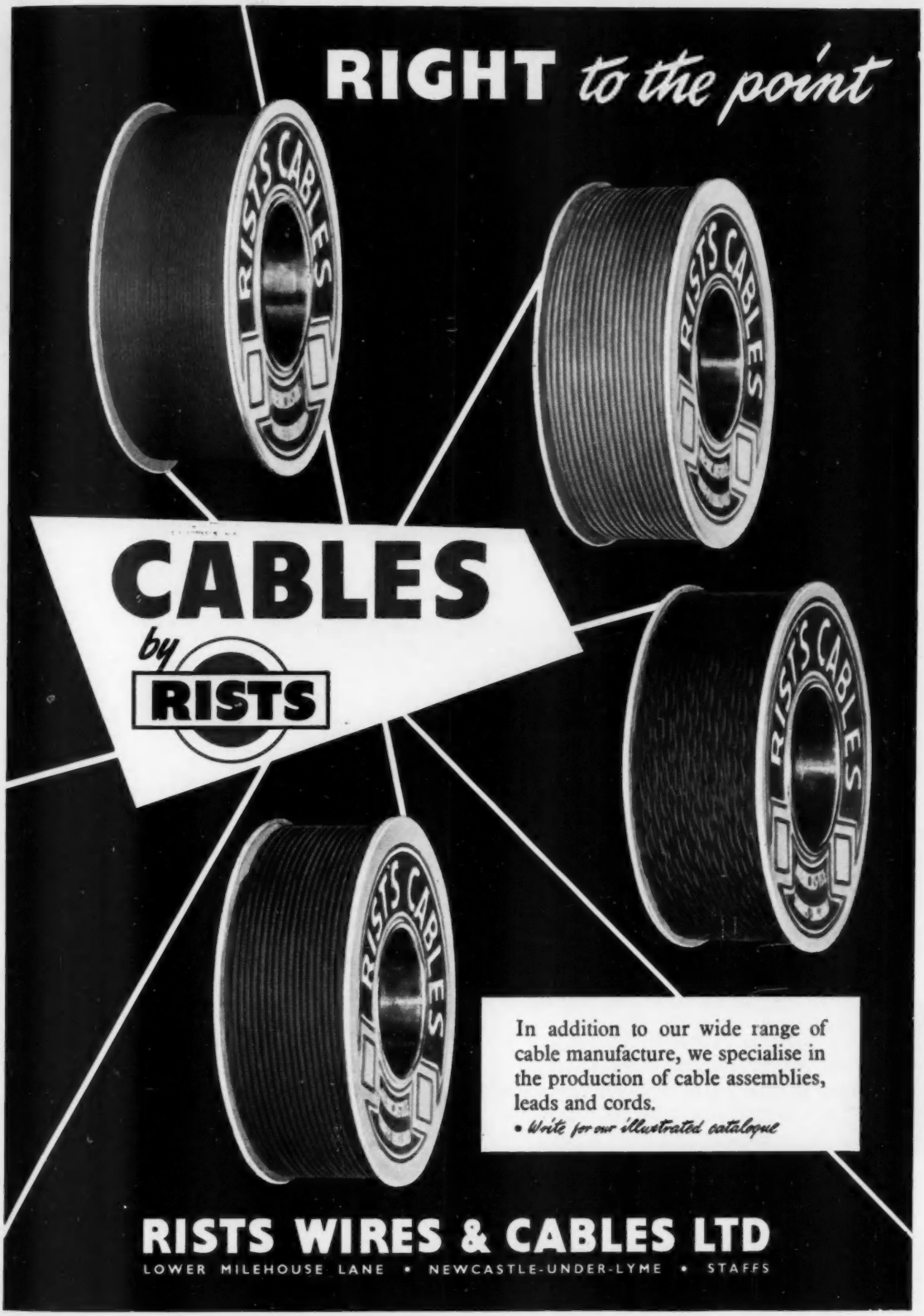
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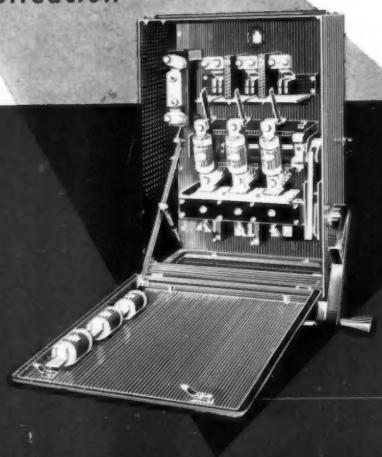

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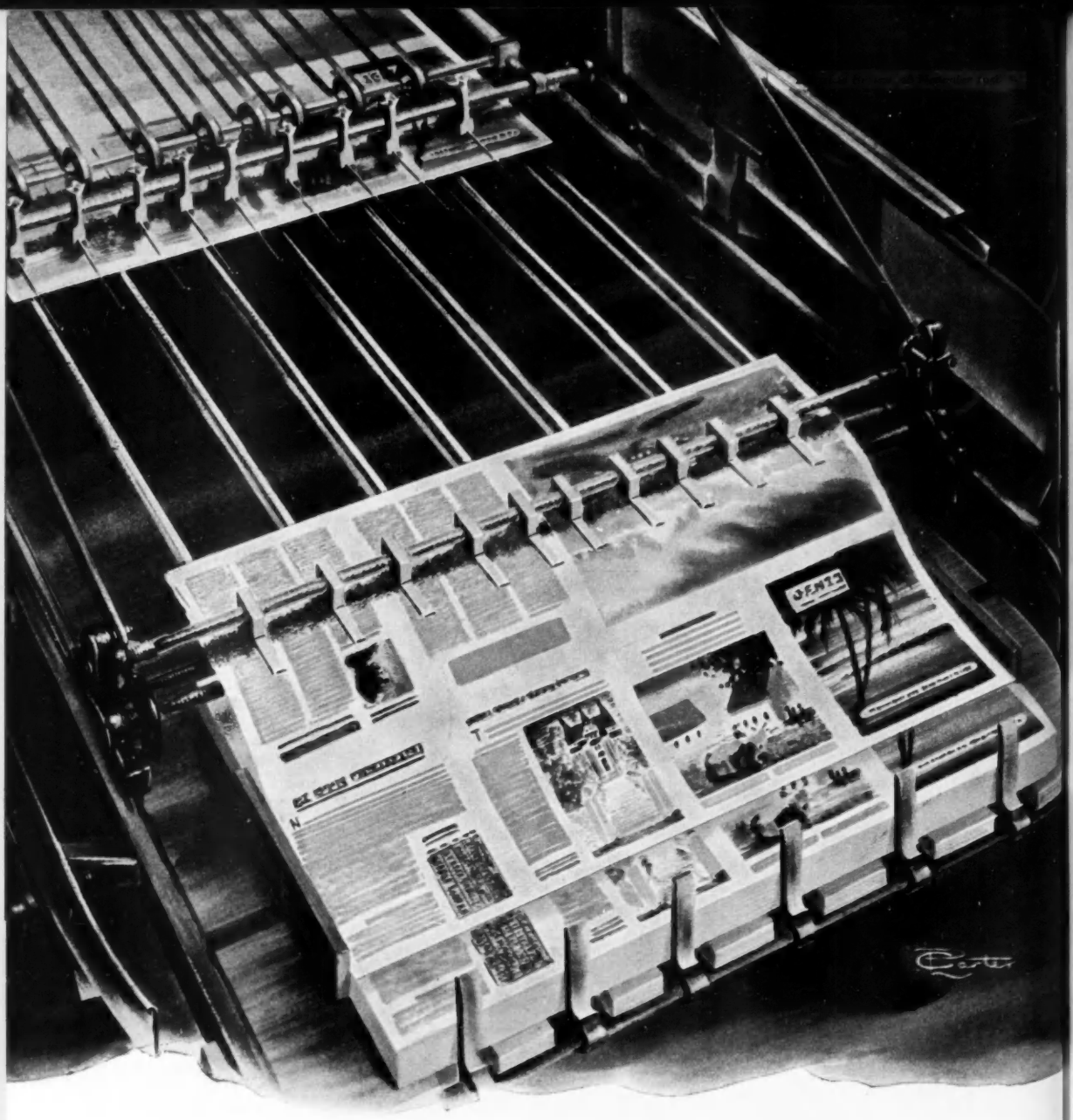

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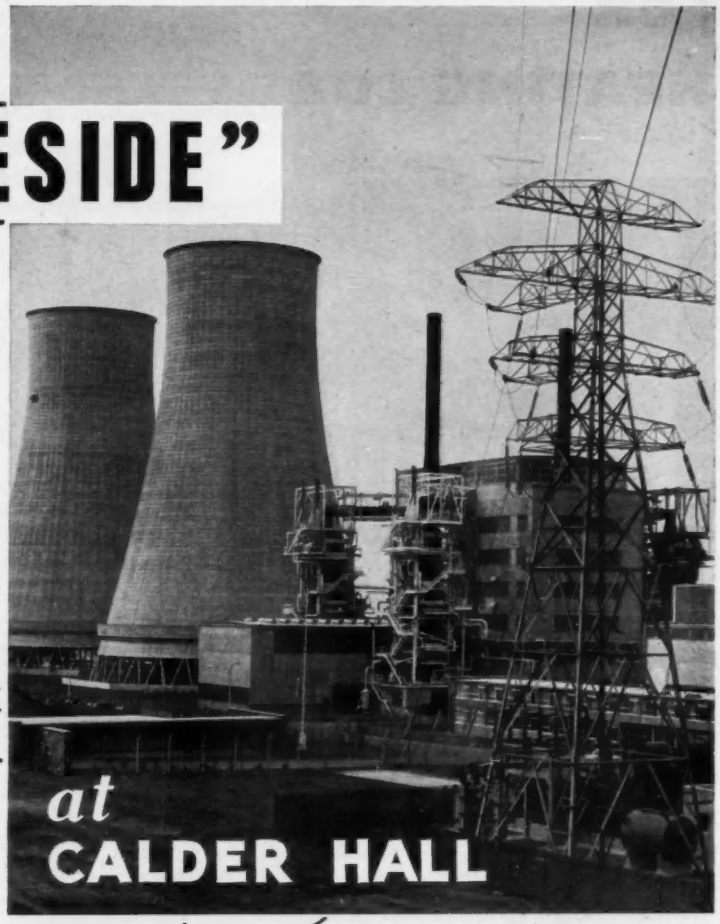

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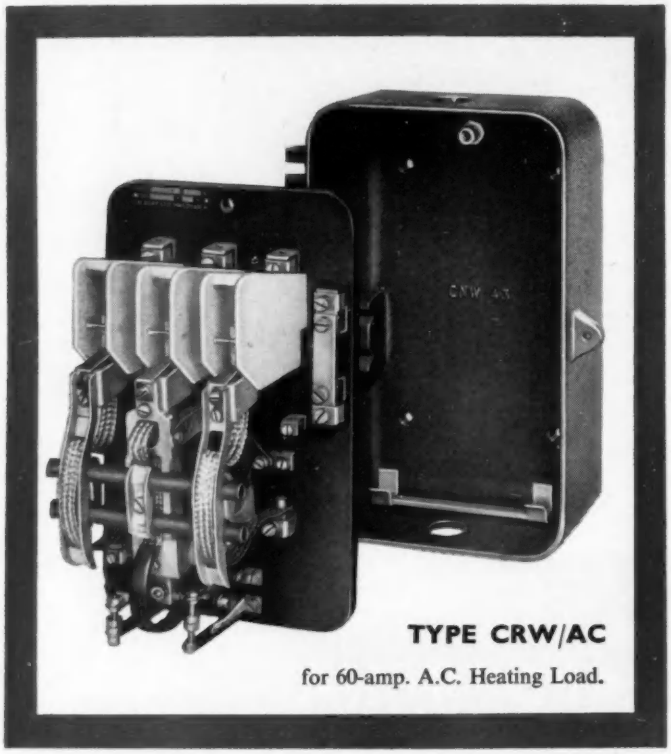

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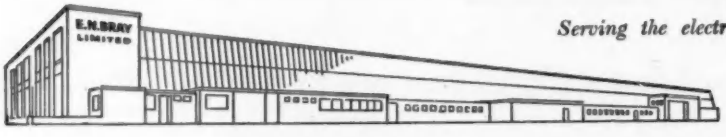

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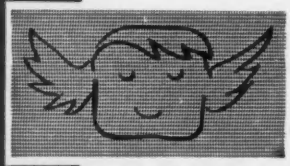

. . . fly

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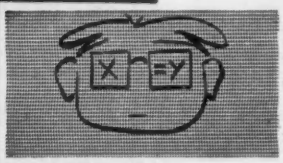

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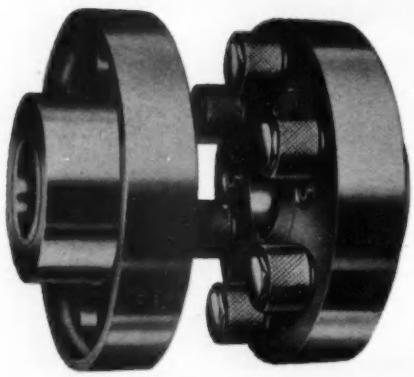

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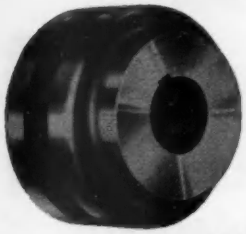

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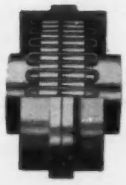

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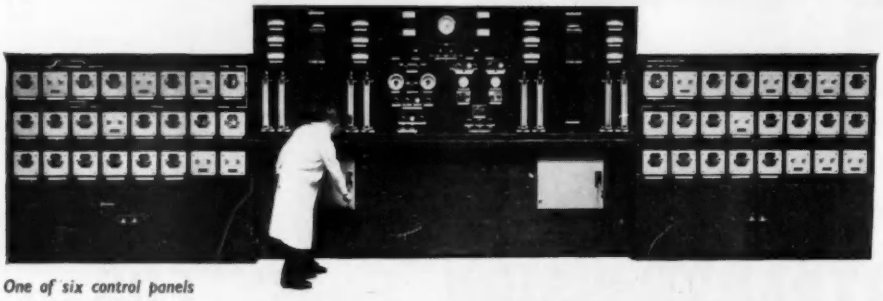

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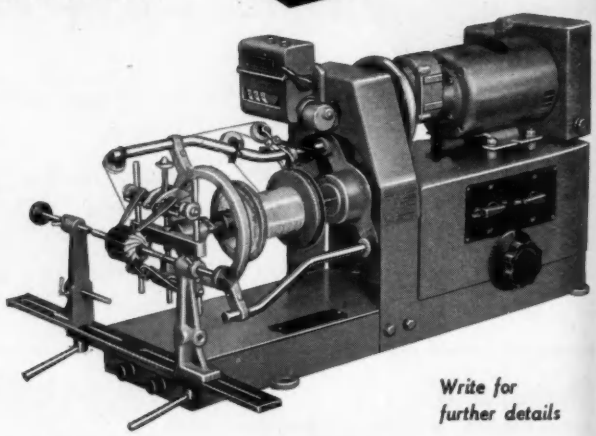

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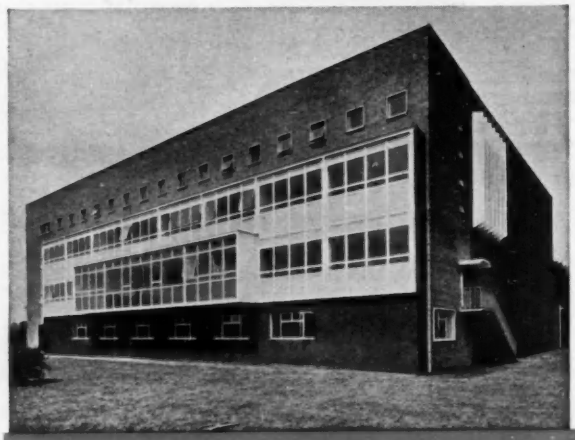

Enfield's new high voltag

Top: The new Laboratory Building.
Above: View of impulse generator control desk and cathode ray oscillograph in the control room of the H.V. testing laboratory.
The artist's impression is of 600 kV, 2.4 MVA, Series resonant transformer/reactor units with feed transformer.

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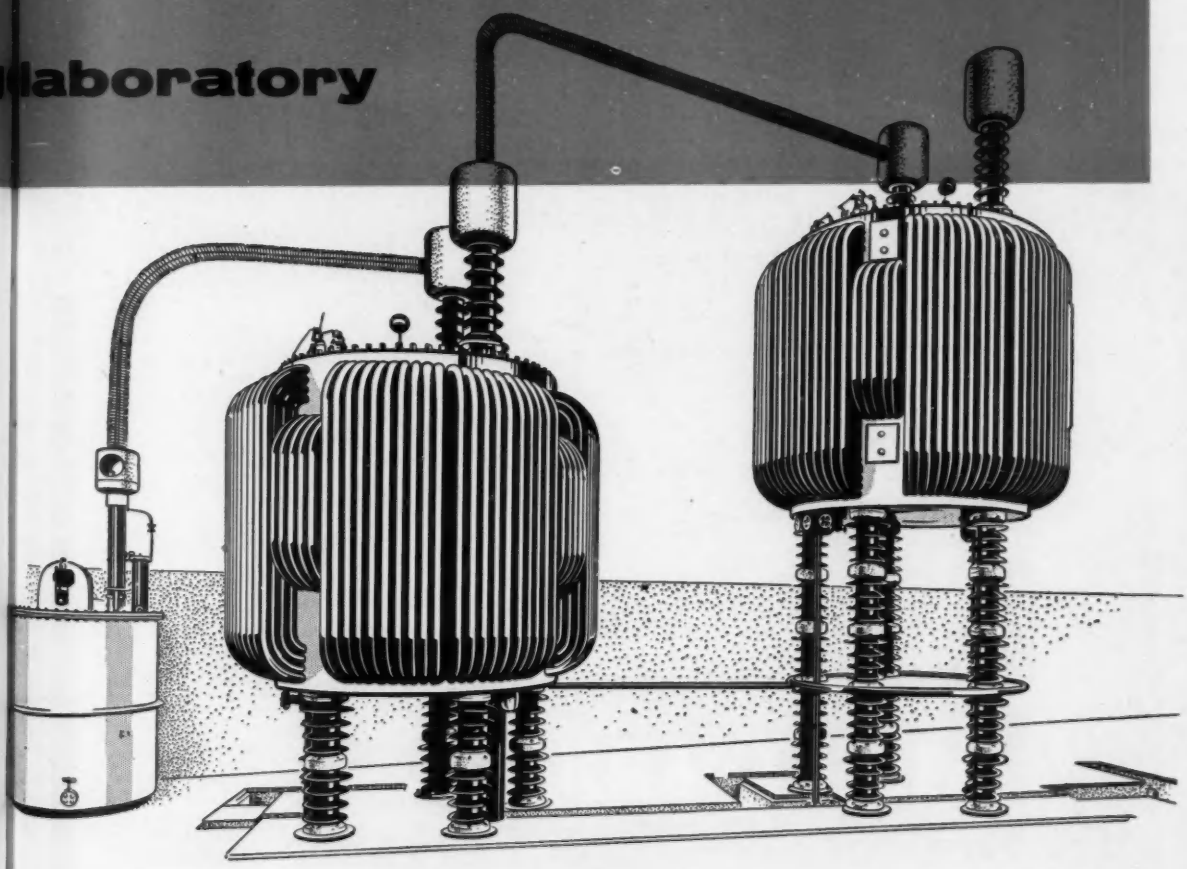
ag laboratory



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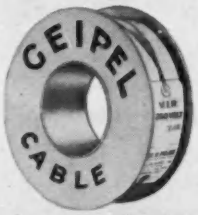

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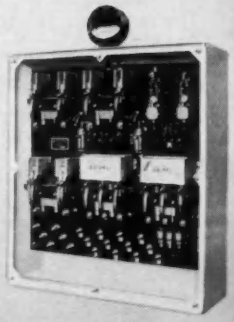

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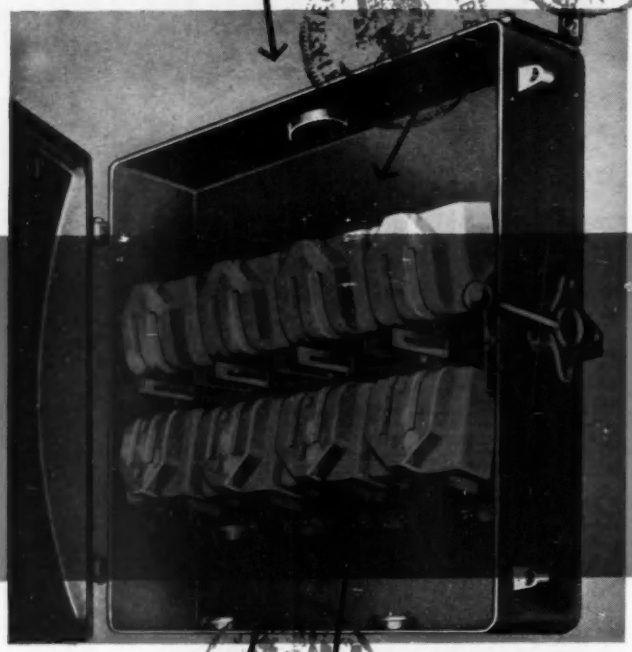

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The instrument shown gives precision test results on continuous and intermittent rated motors between 5 and 20 h.p., with speeds between 3,000 and 10,000 r.p.m. Motors of clockwise and anti-clockwise rotation can be accommodated.

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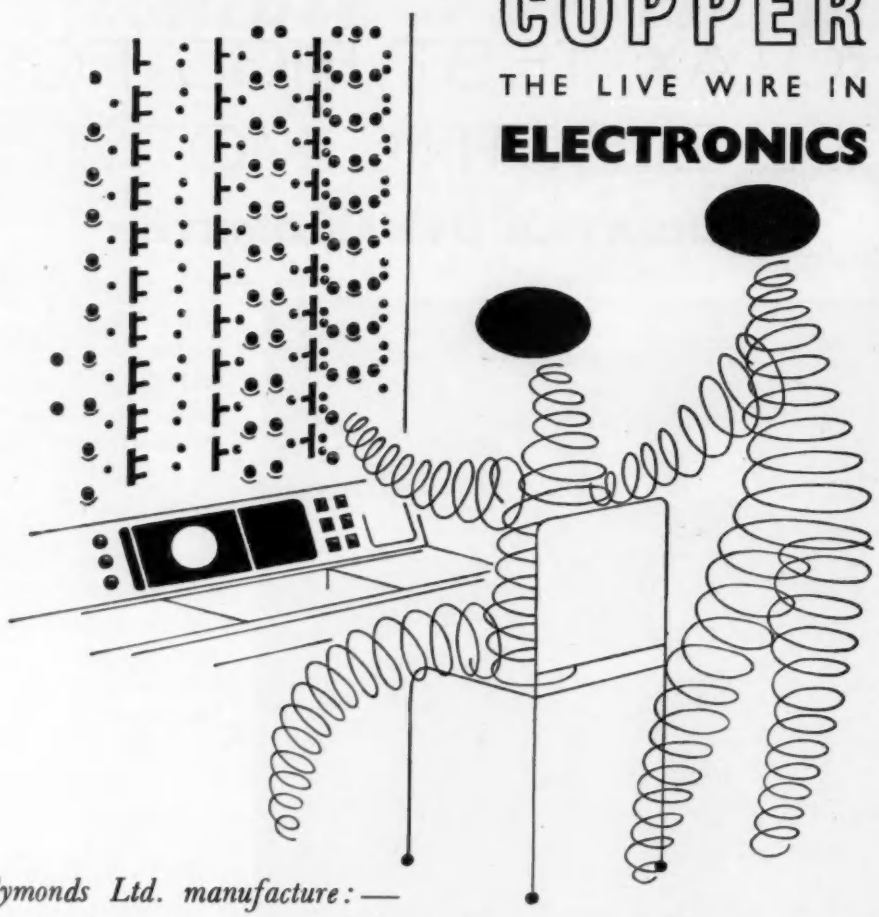
THE LIVE WIRE IN

ELECTRONICS



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High conductivity copper wire, strip and strand for the Electrical Industry. Soft annealed and hard drawn wires, plain and tinned, drawn copper strips and copper strand.

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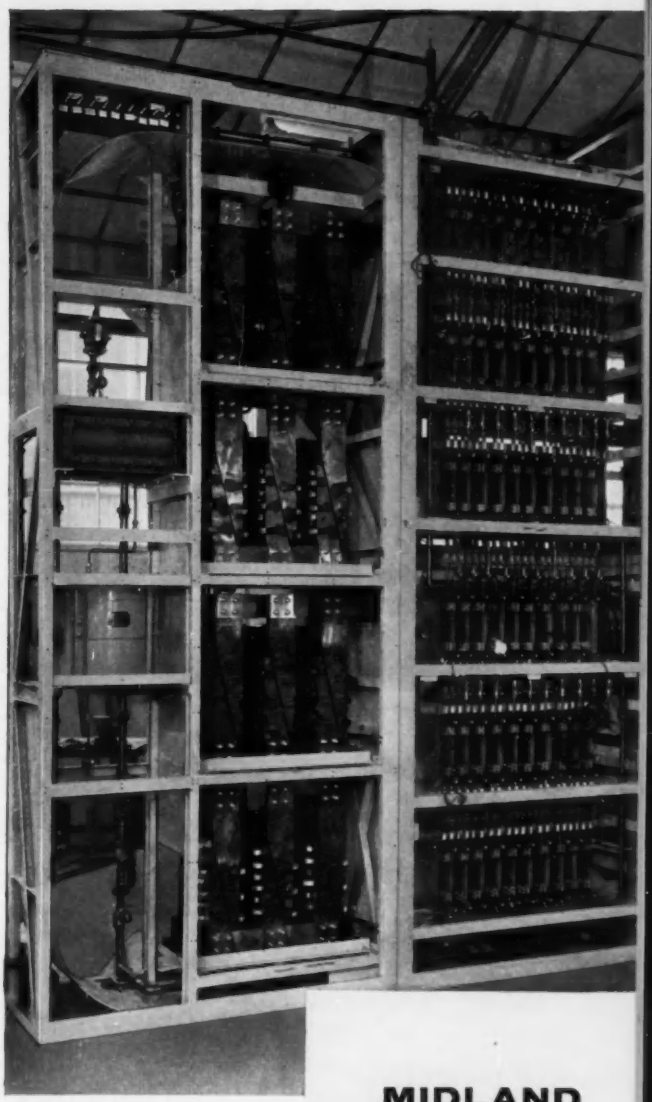
MS SILICONES

serve the electrical industry

PAGE 1

Higher performance, fewer breakdowns with MS silicone insulation

Silicone-insulated dry-type transformers are safer!



Four 56 kVA Class H transformers incorporated in a Westinghouse rectifier equipment. This is part of a 12,000 kVA installation comprising 243 Class H transformers made by Transformers (Watford) Ltd. The installation supplies heavy current to electrolytic tinning lines at the Velindre Works of the Steel Company of Wales.

By taking full advantage of the new Class H and Class C insulation ratings, dry-type transformers can be made smaller and lighter in weight than O.N. or Class B units and are free from fire or explosion risks. They can be placed at load centres making shorter low-voltage cable runs possible. Class H and Class C dry-type transformers are easily maintained, dust, humidity and ventilation proving no problem.

Midland Silicones Ltd. manufacture the full range of silicone resins and elastomers used by transformer manufacturers in the construction of silicone-insulated dry-type units.

(Photograph by courtesy of Westinghouse Brake & Signal Co. Ltd.)

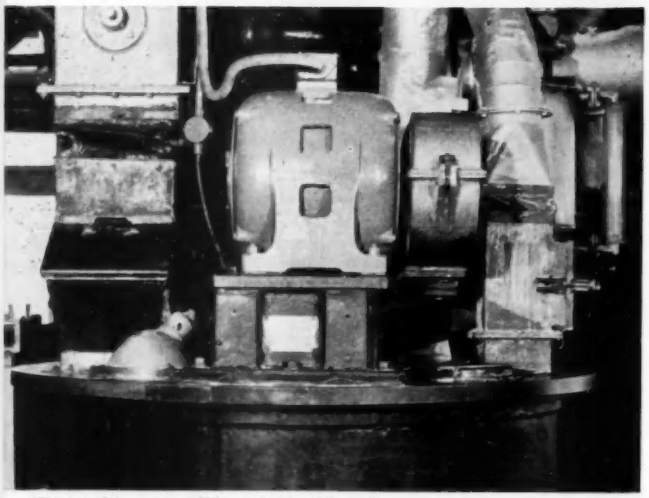
YBW/BS 90

MIDLAND SILICONES LIMITED

PAGE 2

MS silicone motor rewind saves £400

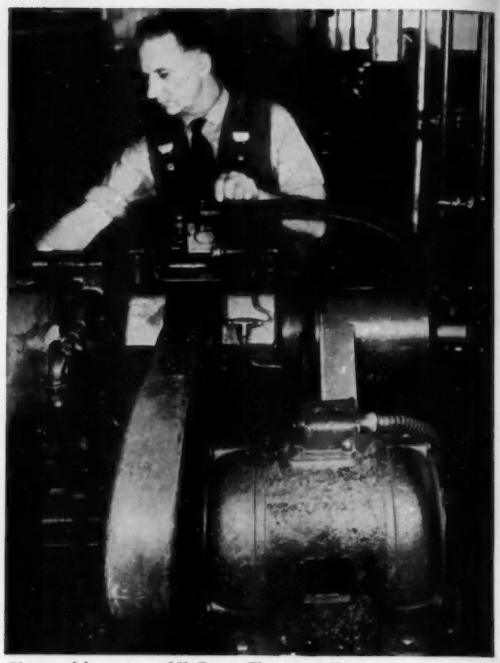
Thomas Hedley & Co. Ltd., at the company's West Thurrock factory, found that one of their motors working in a particularly wet position broke down at average intervals of six months. Rewinds were tried in Class A insulation (costing £30 each time) and in Class B insulation with extra varnish dips to give additional protection against moisture—both without success. Finally they tried a silicone rewind. This was nearly seven years ago and the motor has been operating since without failure, thus saving approximately £400 in rewind costs. In addition losses in production time due to motor failure have been eliminated.



(Photograph by courtesy of Thomas Hedley & Co. Ltd.)

MS Silicones strengthen the weak link in all forms of electrical equipment—its insulation. With silicone-insulated motors the risk of breakdown through insulation failure is very greatly reduced. Have your most troublesome motors rewound with silicone insulation.

MIDLAND SILICONES LIMITED



Photograph by courtesy of Hoffmann, Gloucester Ltd.)

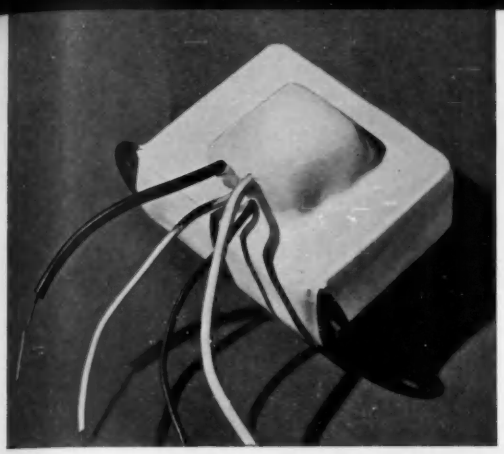
MS silicone-insulated motors withstand years of continual 'plugging'

The photograph shows a silicone-insulated motor operating at the Stonehouse Works of Hoffmann, Gloucester Ltd., who have kindly provided us with the following information. "We have a bank of 12 machines, each being driven by a 2 h.p. 1425 r.p.m. motor and as the motors burnt out they have been rewound with silicone insulation by British Electrical Repairs Ltd., and this has proved very satisfactory over the past 2 to 3 years.

These motors are working in unusual conditions, as the following description of their working cycle shows, and they stand up to the work very well indeed.

A complete operation takes 12 seconds then the machine is operated to reload which takes 2 seconds. To decelerate rapidly to the stop position for loading the operator presses the stop button followed by 'plugging' (pressing the reverse button). This is drastic treatment when continued all day and speaks well for the rewound motors."

This is a typical example of how MS silicone insulation increases the life and reliability of hard working motors . . . saves money by reducing the need for frequent rewinds and replacements.



New MS 'do-it-yourself' rubber for encapsulating electrical components

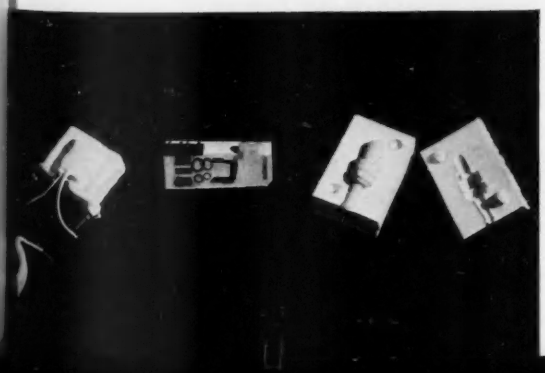
MS Cold-Curing silicone rubber needs no heat to cure—a simple technique enables it to be applied even by unskilled operators—the addition of a catalyst is all that is required to cure at room temperatures. The curing time may be varied from a few minutes to several hours according to the proportion of catalyst added. MS Cold-Curing rubber possesses the excellent dielectric properties, heat endurance and high thermal conductivity associated with silicone rubbers. The material retains its resilience at both high and low temperatures (–50°C to +300°C) and has excellent resistance to weathering and oxidation.

MS Cold-Curing silicone rubber opens up new fields for designers. It can be used to fill voids around lead wires of coils and motors, for impregnating coils and for other sealing or potting applications.

MS Cold-Curing silicone rubber is also used for making flexible moulds in which epoxide resins are cast.

TYPICAL PROPERTIES OF MS COLD-CURING SILICONE RUBBER

Tensile strength lb./sq. in.	450
Electric strength, on 10 mil sample, ¼-in. electrodes in oil at 20°C instantaneous value, V/mil	400
Permittivity, at 1 Mc/s	3.20
Volume Resistivity, ohm.cm, 500 Volts D.C.	1.5×10^{14}
Power Factor, at 1 Mc/s	0.006

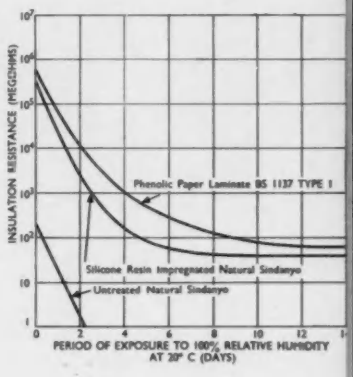


'Natural Sindanyo'* improved by MS resin impregnation

The Steel Company of Wales Ltd., have, for some time, used a resin bonded wood material for panels for mounting contactor control gear. Several fires occurred in some hot and dirty locations when surface contamination of the panels resulted in tracking and breakdown. This Company have now decided to use Silicone Resin Impregnated Asbestos Board in place of the wood material in these locations and, at present, carry out the impregnation process themselves using MS Silicone Resins.

THE EFFECT OF HUMIDITY ON THE INSULATION RESISTANCE OF NATURAL SINDANYO BOARD

Test methods based on B.S. 1137 appendix H


INSULATION RESISTANCE (MEGOHMS)
Phenolic Paper Laminate BS 1137 TYPE 1
Silicone Resin Impregnated Natural Sindanyo
Untreated Natural Sindanyo
PERIOD OF EXPOSURE TO 100% RELATIVE HUMIDITY AT 20° C (DAYS)

'Natural Sindanyo' is widely used as a non-inflammable insulant but is limited in many applications by its high moisture absorption. The improvement in the insulation resistance characteristic under high humidity is shown in the graph with the performance of a well established type of phenolic paper laminate included for comparison.

Silicone Resin Impregnated Sindanyo has excellent thermal endurance and arc resistance. Suggested applications include arc chutes, components for dry-type transformers and domestic heating appliances as a substitute for paper/phenolic board where flame resistance or high anti-tracking properties are required.

** Cement bonded asbestos board made by Turners Asbestos Co. Ltd.*

MIDLAND SILICONES LIMITED

PAGE 4

Navy specifies silicone insulated cables

'The British Admiralty has decided to use silicone insulated cables for all ship wiring purposes in future H.M. Ships. Such cables will have a much longer life than the types now used in the more onerous operational conditions which will be experienced in future ships and will have fire resistant properties which should confer substantial operational advantages.' *Admiralty statement.*

Silastomer* silicone rubber insulated cables will give long term service at temperatures up to 200°C. They show excellent resistance to oxidation and the effects of corona. Even more important, in some applications is the fact that they can operate during and after fire since Silastomer leaves an insulating silica residue after decomposition.

Silastomer insulated wires and cables are used in aircraft wiring systems, ignition and electronic circuits, domestic and other electrical appliances and for general industrial wiring applications where high temperatures occur.

* *'Silastomer' is a registered trademark of Midland Silicones Ltd.*

(Photograph by courtesy of Joseph Lucas Ltd.)

Every service engineer should keep a tube of MS 4 insulating compound in his kit

This grease-like material does not harden or melt over the temperature range −50°C to +200°C. It is anti-tracking, corona-resisting, chemically inert and highly water-repellent. It lubricates, protects and seals disconnectable plugs and sockets, cable harnesses, ignition circuits and terminals. It extends the life of cable covering and flexible bushes and grommets. When lightly smeared on insulators it maintains high insulation resistance under wet conditions.

Technical service facilities

Silicones are used in all forms of electrical equipment as insulation, heat transfer media, lubricants, structural components or seals. Our Electrical Engineers and Technical Service Department are ready to help you in the choice of the silicone product best suited for your application.

For further information and names of suppliers who can offer you MS silicone insulating materials write to:

MS

MIDLAND SILICONES LIMITED

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CIRCUIT BREAKER

The GEOF circuit breaker is designed for mounting on floor stands or for bolting to supports such as steel chambers or stanchions. Now in full production, this new circuit breaker possesses the main features of the successful GEO drawout range including:—*Reversible main and arcing contacts. Free handle on overcurrent. Series-connected, solenoid-operated overcurrent releases with time lags.*

Write for further particulars.

FOR SERVICE VOLTAGES OF UP TO 660

A.S.T.A. TESTED TO B.S. 936:1940

BREAKING CAPACITY 25 MVA at 400 VOLTS

GEORGE ELLISON LIMITED BIRMINGHAM ENGLAND

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FRIDAY
28 NOVEMBER
1958

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

In This Issue

Practical Training 985
To absorb the growing numbers of students passing through the universities and technical colleges it is necessary to increase the number of places in industry for practical training. Particular attention is drawn to group training schemes for smaller firms

Electronic Computer Exhibition 987
The exhibition, the first of its kind in Europe, opens today at Olympia and continues until 4th December. In this article the evolution of computers is traced and brief details are given of some of the new developments to be seen at the exhibition

Cathodic Protection 992
The principles of cathodic protection were outlined and some of the considerations affecting the choice of system explained in a paper presented recently to the Incorporated Plant Engineers

Power Follow 993
Investigations of power follow current phenomena were described in an I.E.E. paper this week and a second paper presented at the same meeting dealt with arc initiation (see page 995)

Overseas Electrical Trade 1005
The recent decline in British exports was arrested in October when the total for the month rose by £4·2 million to £19·1 million

Tests on Narrow Insulating Tapes 1015
Details of work carried out at Henley's Research Laboratories to enable all widths of tape to be tested for dielectric strength

✧ ✧ ✧ ✧

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ELECTRICAL REVIEW

28 November 1958 Vol. 163 No. 22 Established 1872

Practical Training

NEARLY 3,000 students will pass their final examinations at universities and technical colleges in 1965. This is double the present annual figure. To facilitate this increase, the education authorities are carrying out an extensive expansion programme. It is unlikely, however, that the number of places in industry for practical training will increase at the same rate unless something is done now. Only by increasing the number of qualified engineers to keep pace with industrial expansion can this country hope to keep its position in world markets.

The bulk of the graduate and student apprentices are, at present, receiving their training in a small number of large firms. Only a few extra places for practical training can be provided by these firms as they are already carrying the maximum number of apprentices. The duty therefore lies with the small firms who are providing either a specialised training, or even have no training programme at all. The broad training required can, however, be obtained by a co-operative effort by these firms and the formation of group training schemes such as S.E.T.S. (Scottish Electrical Training Scheme). Too many small firms view the cost of practical training as a debit only—a very short-sighted policy.

A conference was held at the Institution of Electrical Engineers last Friday to discuss group training of apprentices and a report appears in this issue. All the speakers, including those who joined in the open discussions, were either from technical colleges or from firms who had already solved their training problems. There were very few, if any, people at the conference who represented firms with no broad training scheme. Although the conference may have achieved something, we feel that the people who would have benefited were not represented.

Before any small firms are likely to want to be represented at such a conference, the directors must have an interest in the subject. We therefore feel that the directors must be individually visited and " sold " the idea of group training. There are probably three main ways in which this could be done. Firstly, by the head of the local technical college, secondly by the education department of the I.E.E., and lastly by the education officer of a large firm. We feel that the last method may be the best.

One method of selecting graduate apprentices employed by the large companies is by sending talent scouts to universities and technical colleges. This may be a good scheme for the large firms but we do not altogether agree with it. If these firms

could be persuaded to set up group training schemes and include a number of small firms in their neighbourhood, the problem of practical training would be solved as well as a number of other problems. The small firms would get their share of the better students and would not need to attract them away from the large firms. The not-so-good students would feel that they had not been left out and the general level of training schemes would benefit.

As one speaker said at the conference, something must be done now and we think that this must take the form of personal contact.

NATIONAL BOARDS' REPORTS

People who are responsible for the preparation of an annual report rarely anticipate the task with much pleasure. It interferes with their "normal" work, their repeated efforts to obtain details on time are unpopular, and drafts and proofs make arduous progress at the highest levels. As a result, once an acceptable formula has been found, the tendency is to repeat the same sort of information year after year with often only thinly disguised variations of wording and the insertion of the appropriate figures. To allow reports to become too stereotyped is to neglect an admirable medium for making the activities of an organisation more widely known and better understood.

While the annual electricity supply reports contain a commendable amount of information, for the most part the texts are unnecessarily "bitty" and the style rather unimaginative. On the other hand the Gas Council's report gives a more readable account of the progress and policies of the industry, and in some directions is also more informative. For example, there are more extensive and detailed references to utilisation, including figures of the appliance sales of each of the Boards.

With the change in organisation of the supply industry, the Electricity Council has a chance to be original when it prepares its first full report next year. We should like to see this consist mainly of a well-written summary of technical and commercial developments over the whole range of the industry, from nuclear power to house wiring, with some explanation of the policies which lie behind them. Such a document could be of great benefit to the electrical industry generally.

BOILER AVAILABILITY

Rapid fouling of external surfaces of boilers when fired with high-chlorine coals has been generally attributed to vaporisation of alkali compounds, though the comparative freedom of boilers from this trouble in some power stations has suggested the influence of other factors. Investigations by the Boiler Availability Committee, referred to in "Fuel Research 1957" recently issued by the Department of Scientific and Industrial Research (H.M. Stationery Office, 4s 6d), indicate that, contrary to previous views, the cause is not the alkali vaporised, which is little affected by the type of boiler, load, operating methods or fuel-bed conditions.

The amount of sodium compounds vaporised showed no close correlation with the chlorine or ash contents of the coal. The better availability appears to be mainly due to wide pitching of screen tubes and wide lanes at intervals in convection superheaters with a large space above them.

PROGRESS IN BOILER DESIGN

It is only a few years ago that we would have considered a 60 MW (equivalent) boiler to be very large and not so long since a 30 MW single unit was in the same category. In quite a short space of time boiler ratings have increased up to 100 MW, 120 MW, 200 MW, 275 MW and now to 550 MW in a single unit. Evaporative capacities have accordingly risen from about 300,000 lb/hr for a 30 MW unit to the impressive figure of 3,750,000 lb/hr for the latest 550 MW boiler.

The last-mentioned unit is the one which has been ordered by the Central Electricity Generating Board from International Combustion, Ltd., for installation in the projected Thorpe Marsh generating station. Particulars of the design of this boiler were published in last week's issue and some idea of the magnitude of the project which has been undertaken by the boiler manufacturers can be gained from the fact that in drawing office time alone 100,000 man-hours will be required. The successful design, construction and operation of the Thorpe Marsh boilers will undoubtedly contribute a great deal to British prestige.

NUCLEAR PLANT EXPORTS

After many preliminaries, work on the 200 MW nuclear power plant for the Italian concern A.G.I.P. Nucleare was actually inaugurated on 20th November. This contract represents a triumph for the Nuclear Power Plant Co., who are responsible for the station, and for Great Britain.

On the same day it was announced from Tokyo that the Fuji Electric Co. had concluded a contract with the General Electric Co., Ltd., for technical co-operation in the development of nuclear power in Japan on a royalty basis. The United Kingdom Atomic Energy Authority is also concerned in the agreement. One report stated that the contract was made in anticipation of the award by the Japanese Atomic Power Generating Co. of an order to the General Electric Co. but this was denied by the G.E.C. which pointed out that it was only one of three groups who had put in tenders for the first Japanese nuclear power station. The agreement would associate the Fuji Electric Co. with any contracts which the G.E.C. might gain in Japan or other Far Eastern countries.

WATER HEATERS

Next week's issue will contain an illustrated survey of domestic thermal storage water heaters. Models available range from small sink water heaters to 20-30 gal types, and a number are obtainable in colour. Details given will include capacity, loading, finish and price

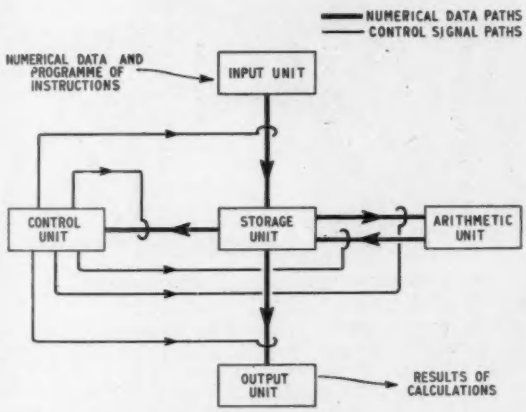
Electronic Computer Exhibition

FIRST SHOWING OF A NEW INDUSTRY AT OLYMPIA

Today a comprehensive exhibition of electronic computers, the first of its kind in Europe, is being opened by the Lord Mayor of London at Olympia. This article gives a general background picture of digital computers in Britain, tracing their evolution, briefly outlining their mode of operation and covering the different types and classes of machines. It concludes by mentioning some of the new equipments and recent developments in electronic computing which are being demonstrated at the exhibition

TWO organisations are responsible for the Electronic Computer Exhibition now being held at Olympia—the Electronic Engineering Association (E.E.A.) and the Office Appliance and Business Equipment Trades Association (O.A.B.E.T.A.). This is a significant fact because it reflects the two distinct lines of development—electronic and mechanical—which have led to the electronic digital computer as we know it to-day. (Analogue computers are on show as well, but the emphasis is on digital machines.)

The mechanical line of development was, of course, the earliest to begin, with the simple, wheel-type calculating machines of the 17th century. This led to the familiar office calculators and punched-card machines which became well established in commerce and industry long before electronics appeared on the scene. A signpost on the road was the highly original work of Charles Babbage, the 19th century Cambridge mathematician, who designed an "analytical engine" which incorporated a "store" for holding the partial results of calculations, a punched-card system of feeding in numbers and a direct printing mechanism for the output. But the signpost was pointing in a direction which nobody was prepared to follow at the time (mainly because the "engine" was never completed), and it was not until about 70 years later that the principles laid down by Babbage were successfully put into practice by electro-mechanical and electronic techniques.

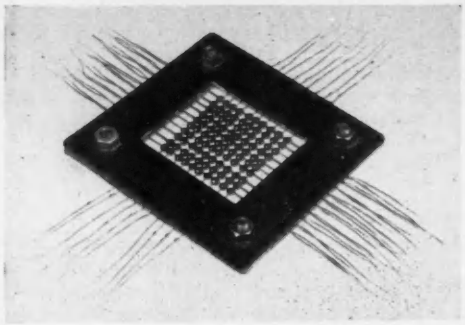


Simplified block diagram showing the main functional units of an electronic digital computer

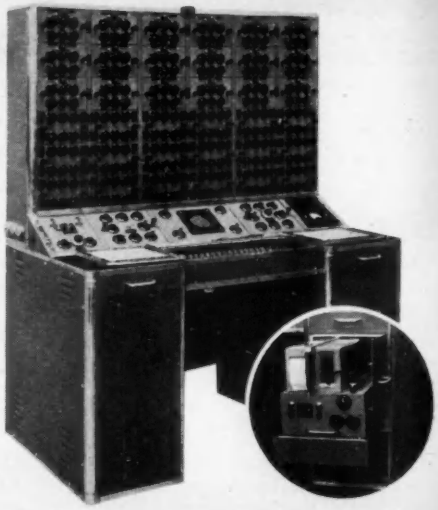
The first electronic digital computers, in which numbers were represented by trains of electrical pulses, came on to the scene during and after the last war (the ENIAC in America being designed mainly for ballistics calculations). They incorporated all of Babbage's ideas, in electronic form, and also the principle that each step in a calculation need not be under the direct control of a human operator, but could be set in motion automatically by a "programme" of instructions prepared in advance. This automatic "sequence control," as it was called, and the use of electronics in place of mechanical parts, resulted in machines of great versatility and incredibly high speeds of operation.

Such computers were built mainly by universities and Government organisations for purely scientific calculations. Commercial electronic manufacturers became interested in them and began to produce engineered versions for the same sort of work—but, of course, this highly specialised market was strictly limited. At the same time the business machine manufacturers, having reached an advanced stage of mechanical development, began to see the possibilities of combining such electronic computing techniques with their existing and well-tried office machinery. (Already the "scientific" computers were using modified punched-card machinery for input and output purposes.) But it was clear that the business machine manufacturers did not have the same experience of electronic techniques as the electronics firms and

A quick-access magnetic-core storage system of the matrix type produced by Plessey. The cores are switched by coincident current pulses in the x and y wires (energising windings) which are threaded through them



National-Elliott 802 desk type transistor/magnetic-core computer. It forms the heart of a new Panellit data processing and information system for application to a U.K.A.E.A. nuclear reactor



The well-established Short Brothers & Harland analogue computer, with (inset) the Kelvin Hughes pen recorder used for recording solutions

conversely the electronics manufacturers did not have the necessary specialised knowledge of the requirements of the business world.

It was inevitable that a wholesale joining of forces should take place—Ferranti with Powers-Samas, Elliott with National Cash Register, G.E.C. with British Tabulating and so on. The result is the British electronic computer industry, as exemplified by the combined efforts of the E.E.A. and the O.A.B.E.T.A. at Olympia. It is clearly aimed principally at the business "data processing" market, but also caters for the scientific world and, in fact, some of the computers produced to-day are adaptable to either business or scientific calculations. In general, though, the business computer is designed to perform very simple calculations, working for long periods on large masses of numerical data, while the scientific computer has to deal with very complex calculations but works more intermittently on small amounts of data.

Before considering the various types of computer in any more detail it may be as well to outline the general organisation of a typical machine, as it has evolved from the two main lines of development. Functionally, it can be depicted as in the block diagram. There is an arithmetic unit which performs the normal arithmetic operations of addition, subtraction, multiplication and sometimes division. Numbers are presented to it from storage locations in the storage unit and the partial results of calculations are passed back to other storage locations. The numerical data on which the calculations are to be performed are presented in the form of punched cards, punched tape or perhaps magnetic tape to the input unit, which "reads" them—in other words, converts them into electrical pulses and passes them to the storage unit. The output unit, at the end of the calculation, "writes" the temporarily stored results back into the card or tape media.

The required sequence of arithmetic operations is ordered by the control unit, which is basically a system of electronic switches and is, in turn, controlled by a "programme" of instructions. These instructions, worked out in advance by a human "programmer," are coded into numerical form and fed by punched cards or tape into storage locations in the same way as the original data. They are selected in turn from store by the control unit and are interpreted as switching arrangements which, for example, can transfer numbers between the storage unit and other units and also set the connections of the arithmetic unit to perform whatever operations are required.

Stantec Zebra computer of Standard Telephones & Cables, Ltd.

In some of the simpler computers the programme of instructions is stored in the form of patterns of connections which are set up by hand on a plug-board, and these are automatically "scanned" in sequence by the control unit. In even simpler machines, sometimes known as "calculators," there is no sequence of instructions supplied from outside. The computer can only perform a fixed routine, such as multiplication, which is set by the wiring connections.

As already mentioned, the numbers (and coded instructions) are represented by electrical pulses inside the machine. In the great majority of computers this is done on the binary system of notation—a pulse at a

particular instant of time or on a particular wire representing a "1," and a space (or absence of a pulse) at a particular instant or on a particular wire representing a "0." Whereas decimal numbers are formed on the base 10 and the decimal places (working from right to left) have values 10^0, 10^1, 10^2, 10^3, 10^4, etc., the binary code is formed on the base 2, and the corresponding positions (again working from right to left) have values 2^0, 2^1, 2^2, 2^3, 2^4, etc. As an example, the decimal number 25, i.e. $(5\times10^0)+(2\times10^1)$, is represented in binary as 11001, i.e. working from right to left $(1\times2^0)+(0\times2^1)+(0\times2^2)+(1\times2^3)+(1\times2^4)=1+0+0+8+16=25$.

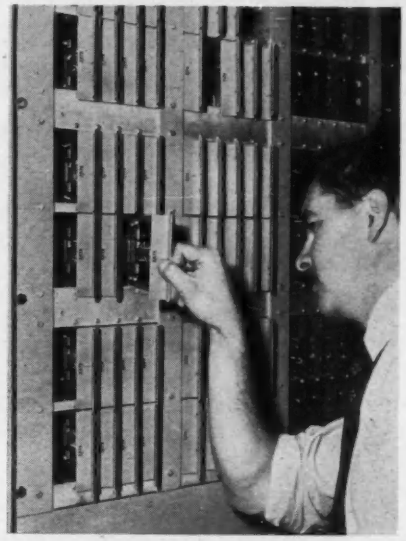
The reason for adopting the binary system in digital computers is that all numbers can be represented, or operated upon, by electronic circuits and devices with only two states—on and off, or conducting and non-conducting. This makes for very simple and uncritical operation, and consequent freedom from errors, which would not be possible if the circuits had to have, say, ten stable states to work in the decimal system. There are, however, some computers which do use the decimal system. These are either "straight decimal" machines designed around special ten-position electronic tubes of the Dekatron type, or the intermediate "binary-coded decimal" machines in which the arithmetic operations are done in decimal fashion on numbers having individual digits coded in binary form.

In physical form, the computer usually centres around a large cabinet or set of enclosed racks which house the electronic circuits of the arithmetic and control units and also, probably, the storage system. The punched card or tape input and output units may be separate equipments or incorporated in the layout of a control desk which, again, may be a separate item or attached to the main circuitry cabinet. The output unit, incidentally, often takes the form of a direct page printer.

What has been called the "storage unit" for convenience in the block diagram actually consists of a variety of different stores distributed all over the machine. There are "quick-access" stores for temporary storage which may hold only one number at a time but change their contents rapidly, and "intermediate-access" stores of large capacity for holding thousands of numbers for longer periods. Magnetic tape and magnetic drums are commonly used for long-term storage, while two-state magnetic cores (with square hysteresis loops), valve circuits and acoustic delay lines are used for short-term storage.

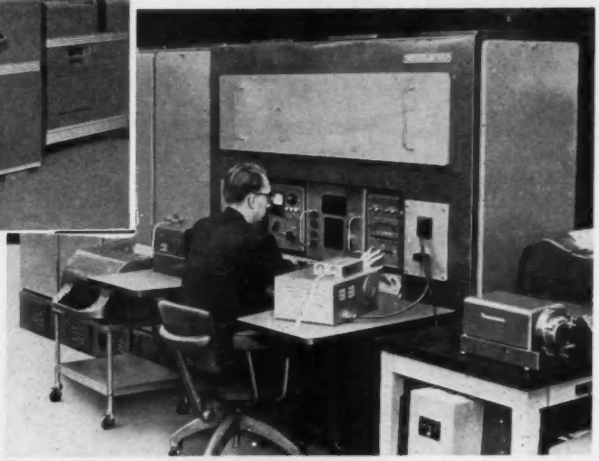
The types of computers being manufactured at present can be roughly classified into three main groups according to size. Physical size, though not of major importance itself, is a rough-and-ready indication of the versatility of a digital computer, in terms of the number of operations it can perform (addition, subtraction, multiplication, etc.). It is also to some extent a guide to the speed and data handling capacity of the machine. The price, which is determined by versatility and capacity, goes in roughly the same proportion—and so does electrical power consumption.

What are generally described as "large" machines cost



Showing how a standard printed-circuit panel of the E.M.I. Emidec 2400 transistor/magnetic-core computer can be easily removed for periodic checks

Above: A small installation, the IBM 421/604 electronic calculating group, with computer on the left, accounting machine in the centre and card punch on the right



Right: Metropolitan-Vickers 950 transistor general-purpose computer

anything from about £80,000 upwards and take up a complete room for the equipment. They usually make available 50 or more operations and work in pure binary notation at quite high speeds—the repetition rate of the digit pulses being 1 Mc/s or above. Often they have a multiplicity of input and output devices and auxiliary storage systems. At the other end of the scale, the description " small " is applied to machines of about the size of a desk or piano or even smaller. They are in the £20,000-and-below price range, and offer up to about ten operations, usually working in straight decimal or binary-coded decimal. The digit pulse rate tends to be low—in the 50-100 kc/s region. Machines with " built-in " programmes determined by the wiring connections fit conveniently into this category.

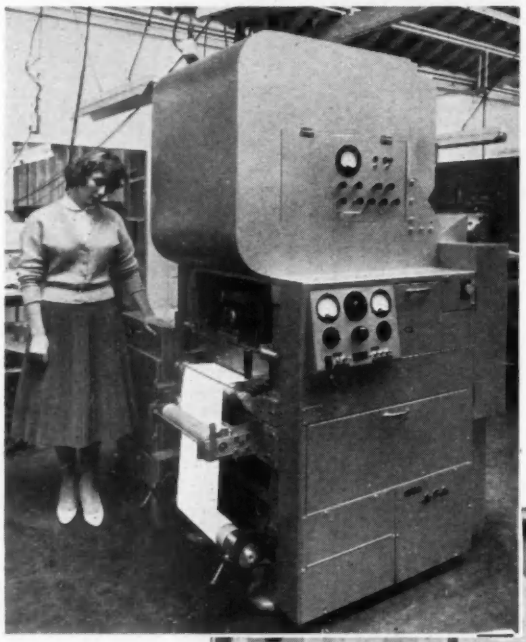
Between these two extremes comes the " medium-size " computer, which is now proving very popular because of its moderate price (in the £20,000-£80,000 region) and adequate number of operations (usually about 20-40) for most practical purposes. The number representation is often binary-coded decimal while the digit pulse rate may be anything from 50 kc/s to 2 Mc/s. Medium-sized computers are manufactured in greater quantities than any other machines (often on a mass-production basis), and as an illustration there are already 1,300 installations of the International Business Machines type 650 computer in operation all over the world.

To take the medium-size computer as an example, the operating speed of a typical machine might be in the region of 1 millisec for addition, subtraction and transfer operations, 5 millisec for multiplication and 10 millisec for division. The digit pulse rate might be of the order of 200 kc/s. The maximum length of the numbers which the machine could deal with (determined by the storage registers) would be about 40 binary digits. A storage capacity of about 5,000 numbers (40 digits each) might be provided by a magnetic drum, while the punched-card input and output mechanisms would operate at, say, 100 cards per minute. Power consumption would be in the region of 5-10 kW.

The design of the electronic computer is by no means stabilised yet, and there is evidence of considerable development to be seen at the exhibition. In general, the main trends are towards smaller equipments and higher speeds of operation. These are obvious advantages in present-day applications in science, technology and commerce. They are even more essential for the new industrial and military applications in which the digital computer is becoming an integral part of automatic control systems for such purposes as process control in factories and automatic navigation in aircraft.

Considerable reductions in size are being obtained by the use of transistors and two-state magnetic cores in place of thermionic valves. Apart from its small size, the transistor is very robust, generates practically no heat, is efficient in operation and appears to have a long expectation of life. In addition, it will operate from a single source of power at only a few volts. All these features make it an ideal component for use in the large numbers required for digital computers. Hitherto, the only disadvantage of the transistor has been its low speed of response, which has set a limit to the pulse repetition rates at which it could be used. This problem has now been overcome by the emergence of the latest high-frequency transistors, which will allow operation at pulse rates as high as 10 Mc/s.

Two-state magnetic cores also have the virtues of smallness, strength, long life and efficient operation with no heat loss, but there seems to be no way of making them switch really rapidly between the two saturation states on the square hysteresis loop. Consequently they are restricted to operation at pulse rates up to about 200 kc/s. This, however, does not invalidate their extreme useful-



Above: Rank Precision Industries computer output printer using the Copyflo automatic xerographic machine fitted with a cathode-ray tube head for displaying characters

Right: LEO II automatic office installed by Leo Computers at Stewarts & Lloyds, Ltd., Corby

ness in storage systems. Circuit techniques have been evolved using combinations of magnetic cores and transistors for computing, and several new machines based on this work are on view at the exhibition.

Another technique which has contributed greatly towards compactness is the wholesale use of printed circuits. For some time it has been a common practice to mount the electronic circuitry on small replaceable plug-in units which fit in racks rather like books in bookshelves. Each unit has a definite functional purpose in the operation of the computer, and if it develops a fault it can be quickly withdrawn and replaced by another one, thereby ensuring continuity of service. Nowadays these units are tending to take the form of thin, plug-in printed circuit cards, and where transistors are used instead of valves the overall bulk of the units is very small. Since large numbers of the functional units in digital computers are identical, and many are very similar to each other, the printed circuit technique is the ideal method of manufacture. In some machines large printed circuit boards (without components mounted on them) are used for making the connections between the individual plug-in units.

The Ferranti Perseus data-processing system showing, in the centre the basic computer, at the back left the power supply, at the back right the magnetic tape and punched card control units, the magnetic tape units in the left foreground and the punched card readers in the right foreground

Higher speeds of operation in digital computers can be achieved by advanced circuit techniques, but for a long time the main limitation on speed has been the inability of the mechanical output devices to print or punch out the results at the high rate at which the electronic computation circuits can produce them. This situation has provided a great stimulus for some very original developments. A notable example is the Powers-Samas "Samastronic" output printer which has abandoned the conventional method of printing from type founts and uses reciprocating styli to build up the letters from patterns of inked dots. As a result, it can print on a page at the rate of 300 lines per minute with 140 characters in each line. For punched tape output, Creed have introduced a new high-speed tape punch which is able to deliver coded characters (i.e. patterns of holes across the tape) at the rate of 300 per second.

Probably the most advanced output printer of all on show at the exhibition is the high-speed xerographic machine developed by Rank Precision Industries. This dispenses altogether with mechanical methods of making marks on paper but records photographically, by the dry xerographic process, characters "written" by an electron beam on the fluorescent screen of a cathode-ray tube. By this means the machine is able to print as many as 1,500 lines a minute with 128 characters in each line. Later development will render it capable of printing 3,000 lines per minute.

The new Creed model 3000 high-speed tape punch

It is not possible in the short space of an article to deal with all the ancillary devices associated with electronic computers. These are mostly machines for handling cards, tapes and documents, and devices for converting numerical data from one medium to another, or from analogue into digital representation (and vice versa). There is, however, one extremely interesting exhibit which cannot be omitted—if only because it is almost an electronic computer in itself. This is the Solartron ERA (Electronic Reading Automaton) which "recognises" numerals typed or printed on such things as bills, forms, tickets and till rolls and gives out code signals for punching holes in cards or tape or for feeding directly into a computer. The idea, of course, is to mechanise a task which hitherto could only be performed by expensive human labour.

The printed numerals are passed in front of a cathode-ray tube flying-spot scanning system, which analyses them into small black and white elements rather as in television. The field of view is divided into 100 small areas and the output of the flying-spot scanner is a sequence of pulses indicating that certain of the areas are predominantly black and others are predominantly white. Since there are only two conditions involved the signal can be analysed by binary logical circuits of the kind used in digital computers. These make "logical deductions" based on the fact that each particular distribution of black and white elements means a particular numeral, and as each character is scanned the machine puts out a signal on one of ten wires representing the ten numerals from 0 to 9.

The exhibition covers a good many specialised applications of computing techniques, such as control of machine tools and simulation of mechanical and other systems, and there is also a three-day Business Computer Symposium on the general theme of computers as an aid to management.

CATHODIC PROTECTION

Author's summary of a paper read before the Incorporated Plant Engineers at Dartford on 19th November

By L. B. HOBGEN, O.B.E., A.C.G.I., M.I.E.E., M.I.Mech.E.

CORROSION is a natural electro-chemical process by which a metal reverts in the presence of moisture to a more stable form usually of the type in which it is found in nature. It is normally caused by the flow of direct electrical currents which may be self-generated or imposed from an external source. Where direct current flows from a buried or submerged metal structure into the surrounding electrolyte, corrosion takes place, and such points or areas are said to be "anodic." Where current flows from the electrolyte on to the metal, no corrosion takes place and such areas are said to be "cathodic."

Cathodic protection consists of making all the buried metal sufficiently electro-negative so that current always flows from the electrolyte to the metal and never from the metal to the electrolyte. This principle is well known and easy to state, but its application can be far from simple because there are so many variable and unknown factors.

Taking the case of a buried steel pipeline where the electrolyte is the soil, the ground can change, even within a few yards, from good conducting wet clay to almost non-conducting gravel or from low-resistivity top soil to impervious rock a little below the surface. The chemical contents can also vary over a wide range, and what is more important is the variation in the amount of oxygen in different parts of the soil.

Corrosion engineers often speak of galvanic, electrolytic, concentration cell and stray current corrosion, but, in fact, all corrosion of buried metal structures is electro-chemical and occurs where the current leaves the structure and enters the soil. Whatever the cause, the effect can be greatly accelerated by the action of sulphate reducing bacteria found chiefly in waterlogged clay soil, particularly in the absence of oxygen. These bacteria remove the hydrogen coating on the surface of the steel pipes and form hydrogen sulphide which readily combines with iron so that the effect is two-fold.

Measurement of Potential

The electric potential between buried pipes and the surrounding soil provides the only practicable criterion for comparing conditions before and after applying cathodic protection. The potential is measured by a very high resistance voltmeter and a device called a half-cell which, in the case considered, consists of a copper rod immersed in a saturated copper sulphate solution contained in a plastic cylinder with a porous plug at the bottom for making contact with the soil as near to the pipe as possible.

In general, there is a "natural" potential of -0.3 to -0.6 V between the pipe and the surrounding soil. To prevent corrosion this potential must be augmented until the pipes are everywhere -0.85 V with respect to the soil, or -0.95 V where sulphate reducing bacteria are active. This means that at some parts of the system the potential difference will be considerably higher and care must be taken to keep this as low as possible, otherwise damage may be caused to the pipe coating or protective wrapping, the power consumption increased and lead- or aluminium-sheathed cables in the vicinity endangered.

The current required to protect a pipeline is proportional to its exposed area. The current density for full protection varies from about 3·5 mA/sq ft to 0·1 mA/sq ft depending on whether the pipes are bare or fairly well coated.

Systems of Protection

The protective current can be provided from either a sacrificial anode, usually of magnesium alloy, or from any external d.c. source, the most general being a transformer-rectifier. Financial considerations usually determine which system shall be adopted and these in turn depend on the power supply available, the current requirements and the soil resistivity. There may be instances where, due to very low soil resistivity, or interference with neighbouring pipelines or cables, sacrificial anodes are the obvious choice, but generally an impressed current system will be cheaper and more flexible in the long run.

With an impressed current system the positive terminal of the d.c. supply is connected to the anode or "ground bed" from which current flows through the soil to the pipeline, the circuit being completed by connecting the negative terminal to the pipeline.

The ground bed can be constructed of many things, but, in general, the best material is graphite made up into a number of long graphite rods connected in parallel. It should be installed in as low resistivity soil as possible as its resistance to earth is the chief factor in determining the system's power consumption and hence its annual cost. It should not be too close to the pipeline or to any buried metal. The object is to obtain an even distribution of current towards the protected pipelines. A very careful resistivity survey of the site should be made, preferably by the four-probe method.

In appropriate cases cathodic protection can be very rewarding, but it should be remembered that in congested areas many pitfalls can be encountered, the most difficult being where, in protecting one particular pipeline, neighbouring unprotected installations may be adversely affected. The trouble can usually be overcome by suitably bonding the protected structure to the unprotected installations. However, the solution is seldom easy to accomplish with complete satisfaction to all concerned, besides adding to the cost of the protection as a whole.

There are, of course, many important cases where interference does not occur, such as in long pipelines through sparsely-populated regions and in the applications to ships' hulls and holds and steel piled jetties, and many others which the author had time only to mention.

Almost every cathodic protection system contains some unexpected conditions and adjustments have to be made on site to meet them. Such work can only be efficiently carried out by an experienced corrosion engineer, but it is the fact that no two installations are alike that makes cathodic protection so interesting.

By L. L. ALSTON, B.Sc.(Eng.), Ph.D., A.M.I.E.E., and

Professor F. M. BRUCE, M.Sc., Ph.D., A.Inst.P., M.I.E.E.

POWER FOLLOW

Authors' summary of paper entitled "Investigations of Power Follow Current Phenomena Using a Synthetic Power Source" which was presented at a meeting of the Supply Section of the Institution of Electrical Engineers on Wednesday

WHEN a surge breakdown occurs on an electrical system, a discharge is maintained for a short time by the current associated with the surge. This discharge provides a path for the flow of power-frequency current, and a power arc may develop to carry the fault current of the system at that point; the term "power follow" is applied to this phenomenon. The power-follow arc is not always established, in which case the discharge is self-extinguished and the system experiences only a transient fault. It is therefore of considerable importance to know the criteria for the production of power follow, and to be able to check the ability of devices such as rod gaps and surge absorbers to restrict its development. An understanding of this phenomenon is also important when considering the impulse testing of transformers and other power equipment.

In order to determine the power-follow characteristics of a gap or other device, this has to be connected across a power source and the breakdown is produced from a separate impulse generator, so that the power source is subjected to the impulse voltage. Fig. 1 shows the circuit used for the present investigation. The power source was "synthetic" and comprised an inductor L and a capacitor C; compared to a conventional power source, a synthetic source has the advantage of easier control of variables such as frequency and output impedance, and insulation problems are restricted to the design of the inductor.

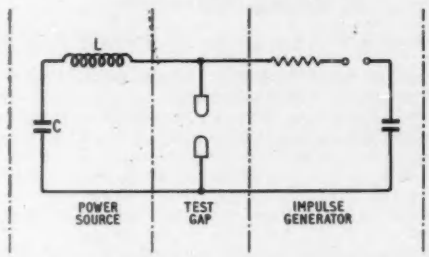


Fig. 1.—Circuit diagram. The capacitor C was charged to a voltage v_o before the impulse was applied

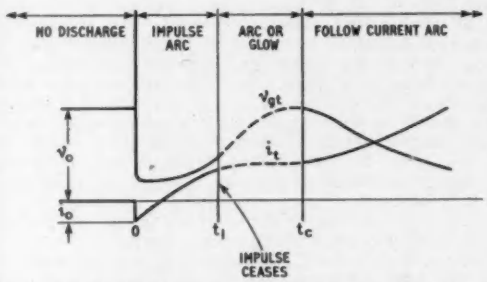


Fig. 2.—Waveforms of power current and discharge voltage obtained with high-voltage follow current

For experimental purposes, power follow was taken to have occurred if a discharge with arc characteristics was maintained at least until the first current zero of the output of the oscillatory power source. The capacitor C was charged to a voltage v_o before flashover; v_o simulated the peak value of the electrical system represented, and was said to be "critical" if it was just sufficient for power follow. Gaps of 0·05 to 10 cm were used, with impulse voltages and currents up to 200 kV and 600 A, and power voltages and currents up to 2·5 kV and 600 A. The power frequency was usually 50 c/s, but values up to 500 c/s were used, and the duration of the impulse discharge varied between 50 and 2,000 microsec in different experiments.

Two types of power follow have been identified, i.e. "high-voltage" and "high-current" follow current. High-voltage follow current operated when the impulse duration was small compared to the period of the power circuit, and Fig. 2 shows waveforms obtained when the power and impulse voltages were positive to earth and v_o was critical. Before the impulse was applied, no current flowed in the circuit, and the voltage v_o appeared across the test gap. When the impulse was applied, the gap voltage rose to the flashover value and then collapsed to the arc value, at time t=0. Due to the time resolution used in Fig. 2 the rise and fall in voltage appear as a single line; nevertheless a high voltage was applied to the power circuit during the time-to-flashover of the gap, so that a current was circulated by the impulse in the power circuit before flashover. At flashover, that current had the value i_o, from which the power current built up subsequently; i_o can be shown to be negative when the impulse is positive, and it therefore opposed power follow when the power voltage was positive (see Fig. 2).

After flashover, an arc was maintained by the impulse until t_1, and subsequently the power current alone flowed in the discharge. A characteristic of high-voltage follow current was that it became established provided the power current had a value of the order of 1 A at t_1. Other workers, for example, Dr. C. E. R. Bruce and Dr. H. Edels, have recorded transitions between arc and glow conditions at these currents, and Fig. 2 shows that in many of the present experiments the discharge degenerated to a glow before the power arc became established. The critical value of v_o was large compared to an arc value, and if v_o was too low for power follow to occur, the discharge was extinguished within a short time from the end of the impulse.

Increasing the impulse duration, t_1, increased the time

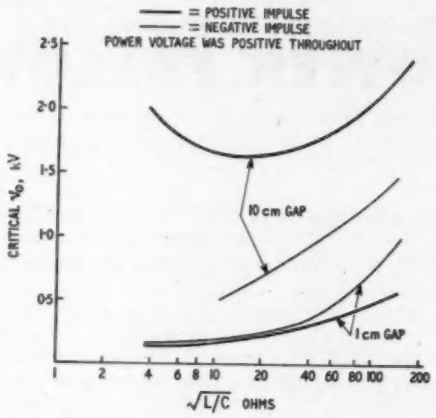


Fig. 3.—Relations between the output impedance of the power circuit and the value of v. required for power follow

available for growth of power current, and this decreased the value of v_o required for power follow. At values of t_1 greater than $\frac{1}{16}$ of the period of the power circuit, high-current follow current operated, and variations in impulse parameters ceased to have an important effect on the establishment of power follow. Under these conditions the critical v_o was of the order of an arc voltage, and even when power follow did not become established a stable arc could be maintained for a considerable time after the end of the impulse.

Two principal polarity conditions exist, depending whether the impulse and power voltage are of the same or opposite polarities to earth. The first condition has been discussed above. Turning to the second condition, when the impulse and power voltages were of opposite polarity, i_o assisted the establishment of power follow. However, the currents circulated by the two voltages in the test gap flowed in opposite directions, so that a current zero occurred before the end of the impulse, and this opposed power follow.

Some quantitative relations are shown in Fig. 3. Increasing the output impedance of the power circuit decreased the rate of rise of current, and for this reason a higher voltage was required for power follow. This is illustrated by the curves for the 1 cm gap, for which i_o was negligible. The curve obtained with negative impulses is the higher of the two because the power circuit had to produce a restrike, while it needed only to maintain conduction when the impulse was positive.

For the 10 cm gap, the relative position of the curves is reversed. This is because the time-to-flashover was longer than for the 1 cm gap: i_o attained a relatively large value, and its effect predominated over the need for a restrike. Again, it can be shown that the increase in v_o which occurred when the impedance was reduced below 10 ohms, was also due to i_o.

Fig. 4 shows the effect of electrode material for gaps up to 1 cm; electrode effects were not significant at bigger spacings.

To sum up, a technique for investigating power-follow phenomena has been established, and two types of power follow—high-voltage and high-current—have been identified. High-voltage follow current occurs if the power current attains values of the order of 1 A, i.e. a power arc is established if the power current attains that value, and the subsequent fault current is determined by the system MVA in a practical case. The establishment of power follow on a high-voltage system can therefore be

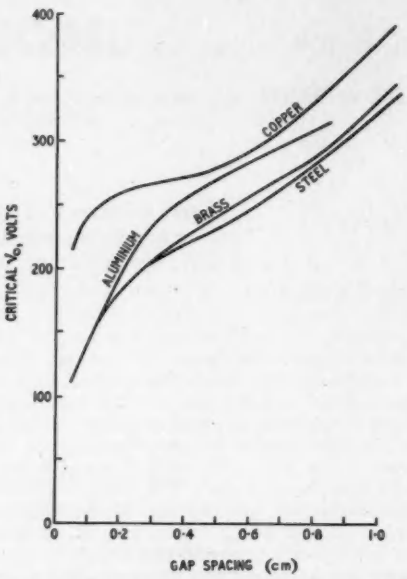


Fig. 4.—Effect of gap spacing on the value of v. required for power follow. The electrodes were 2 cm spheres, which had been conditioned by previous flashovers. Power follow was of h.v. type, and impulse and power voltages were of the same polarity to earth

investigated in the laboratory, using power sources which need only be capable of supplying currents of the order of 1 A.

Acknowledgments are made to the Research Council of the Central Electricity Authority for their support and for permisson to publish the data.

Mining Efficiency

THE Cadman Memorial Lecture was delivered to the Royal Society of Arts on 19th November by Mr. H. A. Longden (Director-General of Production, National Coal Board) who took as his subject "Improving the Efficiency of the Mining Industry." Ever since the war, he pointed out, industrial production had increased at an average rate of about 4 per cent per annum with a consequent expansion in demand for fuel averaging 2½ per cent until 1957, when home consumption fell from 215 to 210 million tons. This year a further fall of 13 million tons from the 1956 level was expected.

Main increases in demand for coal over the past ten years were due to electricity supply (72 per cent), gas (16 per cent) and coke ovens (55 per cent); railway supplies fell by 22 per cent to 11·4 million tons, reflecting the progress of changing from steam to diesels and electrification. While there would be no substitute for coke in smelting, fuel oil was making substantial inroads into engineering and general industry. Recapture of former foreign markets would depend upon ability to guarantee a steady supply over the years at a price that compared favourably with competitors. Nevertheless what was lost to coal in certain fields would, he believed, be made good through growth in electricity generation, which required small uncleaned coal that could be produced most cheaply and efficiently by modern machines in the pits powered by electricity. Much remained to be done; only 28 per cent of the output was got by power loading and even within that proportion maximum efficiency had not yet been achieved.

Present trends in the U.S.A., where the average consumption was 3,138 kWh per annum per domestic consumer compared with 1,617 in Britain, might well indicate future conditions here.

ARC INITIATION

By L. L. ALSTON, B.Sc.(Eng.), Ph.D., A.M.I.E.E.

Author's summary of "The Impulse Initiation of Arc Discharges" which was presented at the same meeting as the foregoing paper. Both will be published in Part A of the *Proceedings* of the Institution

THE current required to maintain an electric arc can be supplied from a low-voltage power source, which need not be capable of producing the flashover required to initiate the arc. The arc may then be initiated by a high-voltage impulse from a separate generator, and this investigation was undertaken to examine the discharge characteristics and to determine criteria for arc initiation.

This mechanism of arc initiation operates also when a power-follow arc is established on an electric system in the path of a surge breakdown, and the circuit described in the paper on "Power Follow" (page 993) was used in a series of experiments on gaps up to 1·5 cm. Aluminium, brass, copper, platinum, steel and tungsten electrodes were used, either in the shape of rods, whose arcing surface was of the order of the arc roots, or in the shape of spheres or discs, whose arcing surface was much larger. The discs were assembled as shown in Fig. 1, and were used to determine the effect of oxidation and roughening of the electrode surface. To this end, they were either rotated between flashovers, so that each arc was struck on clean metal, or they were fixed so that the arcing surface became heavily oxidised.

In these experiments, the voltage, v_o, to which the power source capacitor was charged before flashover, was given values at which arc initiation was just possible. The impulse was of the same polarity as v_o, and the phenomena which determined whether an arc would be established occurred within a time, t_c, from the instant of flashover; that time was so short that the voltage across the power capacitor can be taken as constant at the value v_o. Oscillograms taken during t_c illustrated the transient character of the discharge; thus the current, which had been of the order of 100 A at the beginning of the impulse, was between 0·1 and 0·7 A just after the impulse had ceased, when the discharge was maintained by the power source alone. At these low currents, arc-glow transitions are known to occur on steady state, and such transitions were recorded in these experiments.

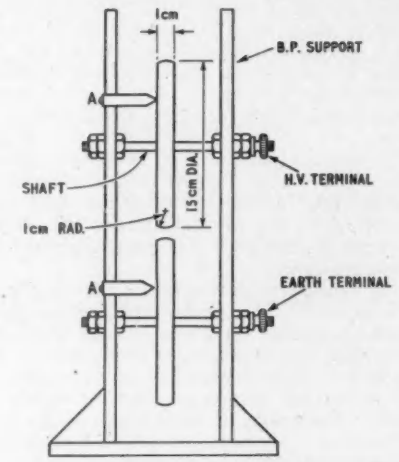


Fig. 1.—Assembly of disc electrodes. Pointers A were used to indicate the angle through which the discs had turned

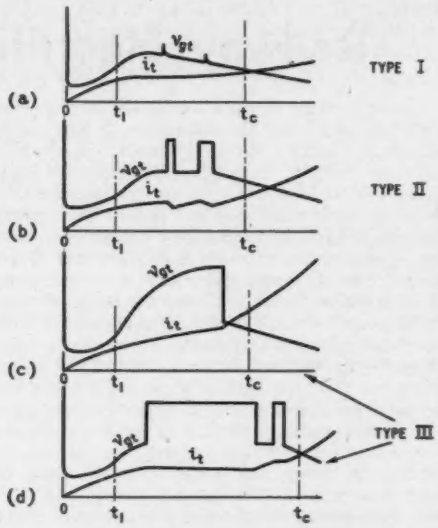


Fig. 2.—Classification of results from waveshapes of discharge voltage and power current. V_{gt} denotes the discharge voltage (i.e. voltage across the test gap)

Fig. 2 shows that results were of three types, depending on the occurrence of these transitions. With Type I, arc-glow transitions either did not occur, or they were followed immediately by glow-arc transitions; consequently, the discharge was maintained at an arc value. For power current to grow, v_o must exceed the discharge voltage, so that in this case arc initiation occurred if v_o exceeded an arc voltage. With Type II, transitions occurred and glow conditions were maintained for several microseconds. It was not necessary in this case for v_o to exceed the maximum voltage of the discharge, because the energy stored in the inductance, L (see Fig. 1 on page 993) could maintain the discharge voltage at values in excess of v_o during the short-duration glow periods. Finally, for Type III, glows of relatively long duration (up to 10 milliseconds) were obtained, and the glow condition was reached either by a gradual rise in voltage or by a sudden transition; v_o had to exceed a glow value for arc initiation in this case.

From these observations and from a quantitative analysis of discharge characteristics, it was deduced that arc initiation would invariably occur if v_o exceeded a value approximately equal to the voltage required to

maintain a steady-state glow in the test gap at a current i_{43}, i.e. the value of the current which would be available from the power circuit at the end of the impulse. Again, it was deduced that arc initiation could not occur if v_0 were less than the discharge voltage just before the impulse ceased.

Experiments showed that arc initiation was much more dependent on cathode than on anode conditions. In general, oxidation and roughening of the surface assisted arc initiation, and this agrees with data obtained by other workers. An exception was observed for aluminium electrodes, in which oxidation and roughening increased the time-to-flashover and this prevented arc initiation under certain conditions.

In conclusion, data have been obtained on discharge characteristics under transient conditions. These have led to the derivation of a criterion for arc initiation, which is a function of the gap in which the discharge occurs and of the power voltage, and is independent of other power circuit parameters.

Acknowledgments are made to Professor F. M. Bruce for his interest and encouragement, and to the Research Council of the Central Electricity Authority for sponsoring this work.

Railway Electrification Comparisons

AT a joint meeting of the Association of Supervising Electrical Engineers and the Institution of Engineers-in-Charge, Mr. R. Ledger (General Electric Co., Ltd.) discussed some aspects of railway electrification on the 25 kV, 50 c/s single-phase system. Advantages of the d.c. motor on the former standard system were stated to be offset by more costly electricity distribution and by needing speed control through a combination of series resistances, field diversion and variation of the number of motors in series, which restricted the range of running speeds compared with a.c. Moreover, to secure equivalent wheel-rail adhesion a six-motor d.c. locomotive would be needed for the heaviest duties instead of a four-motor a.c. unit.

The maximum practicable d.c. contact-line voltage was 3 kV, necessitating a large number of rectifier substations, and a capacity to carry heavy currents, such as 900 A for the continuous rating and 1,800 A peak rating of a 3,000 h.p. locomotive. With an a.c. system 25 kV could be employed and 6·25 kV where clearances were small, the change being made by automatically varying the transformer connections by track magnets.

The Euston to Manchester and Liverpool electrification required only one-sixth of the substations, one-third of the copper and five-sixths of the steel necessary for a 1·5 kV d.c. scheme, but more expensive insulation and more civil engineering work would be required to obtain the requisite clearances. Most countries which had started electrification with high or medium traffic densities adopted d.c., whereas those with low densities generally preferred a.c. at 16⅔ or 25 c/s derived from rotary frequency changers or from special supply networks. This trend had been reversed by the development of equipment for single-phase operation at standard frequency (50 c/s).

Commutator motors were the only a.c. type having suitable characteristics for traction, but these suffered from commutation difficulties due to the transformer e.m.f. induced in the armature coils by the main field flux which could not be compensated by means dependent on rotation. With motors supplied with pulsating d.c. from rectifiers on the vehicle, this transformer e.m.f. could be largely eliminated by connecting a resistance divertor across the motor field, the alternating component of the voltage being absorbed by a series choke. Little modification to standard d.c. motors was required, but commutation was worse and losses greater so somewhat larger machines were needed.

Single-anode rectifiers had been developed, since the multi-anode type as used in substations was too bulky on rolling stock. Both excitrons, in which the arc was maintained continuously by an auxiliary anode, and ignitrons, in which the arc was struck at each cycle from an auxiliary anode fed by a firing circuit, had been employed. Some germanium semi-conductor rectifiers were being built, but their simplicity and lack of auxiliary equipment was offset by their low maximum working temperatures and small overload capacity, which made them a less promising development than silicon.

The a.c. motor had been almost superseded by rectifier equipments for locomotives. The largest contract yet placed for multiple-unit stock was for British Railways—all of the rectifier type. Considerable numbers of motor coaches in Turkey and Portugal used a.c. motors and in view of space restrictions on such vehicles a.c. motors rather than rectifiers might be favoured in the future.

For auxiliaries, conversion from a.c. to d.c. seemed also necessary on account of short interruptions at section breaks, at which phase changes were possible, and for charging the battery which provided power for control gear operation and signalling. On multiple-unit stock the only large auxiliary was a 9 h.p. compressor which had to be started against full load torque, for which a single-phase motor was unsuitable. Locomotives required, in addition, traction motor blowers (40 h.p.) and exhausters (6 h.p.). Alternative methods of dealing with this aspect were mentioned and the hope was expressed that some simplification could be secured by the development of suitable single-phase motors of the power ranges needed.

All goods traffic and most long-distance passenger trains would be hauled by electric locomotives. Local trains would be self-propelled in multiple units, because their schedule speed largely depended on acceleration rate, which was limited by adhesion between wheel and rail, needing the motoring of a higher proportion of axles. Further advantages were increased passenger capacity in a given train length, due to the mounting of traction equipment under the coaches and elimination of shunting at terminals. Locomotives, however, could be detached to work other traffic. Conversion of the main line crossing the Pennines had enabled electric freight locomotives to cover 288 miles per day against 100 miles for the replaced steam locomotives, thus saving £170,000 per annum in wages alone.

For traffic densities too low to justify full electrification, diesel traction was increasingly replacing steam. On low-power equipments hydraulic torque convertors (which required practically as much electrical control gear as purely electric transmission) had been developed and were being used abroad, notably in Germany, but the majority of locomotives in Britain and the U.S.A. employed electric transmission above 500 h.p. and sometimes less. Electric transmission for diesels consisted of a variable-voltage d.c. generator supplying series-wound motors.

VIEWS on the NEWS

By REFLECTOR

OCCASIONALLY, as my readers know, I protest against the adoption of the American habit of employing nouns as adjectives. Two more examples have become very common—consultant and coolant. One reads of consultant engineers, who are either consultants (engineer or engineering consultants if you like) or consulting engineers. The other word, "coolant," is employed in such combinations as "coolant gas" or "coolant water" and should obviously be "cooling." While I am at it I would add an expression of dislike for the tautological phrase "together with" so often used in specifications. Usually "and" is good enough.

* * *

A correspondent who occasionally draws my attention to curious anniversaries says he has discovered that colour identification of electric wiring had its origin just one hundred years ago. In 1858 T. Andrews, M.D., F.R.S., Professor of Chemistry at Queen's College, Belfast, who was an electrical engineer and technician of note in his time, was the first person to mark his positive wires with a small lapping of red ribbon and the negative ones with a similar marker in black and he followed the same rule with the positive and negative terminals. Later in the last century a firm of electricians, Messrs. Coates of Belfast, used red and black terminals in some of their electrical fittings.

* * *

Topic (the A.E.I. newspaper) briefly reports a talk by Dr. A. A. Ware giving an account of the proceedings at the recent Geneva Conference on the Peaceful Uses of Atomic Energy which was attended by a contingent from the A.E.I. Research Laboratory, Aldermaston, Berks. He had something to say on the thermo-nuclear research now proceeding in this country and in Russia and the United States. One of his remarks, as reported, was that

> "an idea of Russian enthusiasm can be gauged from the fact that since January they have built an apparatus similar to Zeta in only seven months."

I am sure that British workers in this field are just as enthusiastic, and as ingenious, but I suspect that they are not so well supplied with money and equipment as their Russian counterparts. When the Soviet Government wants spectacular results it spares no expense.

* * *

Beaminster in Dorset is wondering whether it is about to become an all-electric town, or anyway a town without gas. The *Bridgeport News* reports that at a recent meeting the chairman of the local Housing Committee said that "the question of the big electricity drive was worrying the Housing Committee a lot. The changing over from gas to electricity was an urgent matter." Apparently the Committee is finding a number of gas cookers on its hands because council house tenants are replacing them by electric cookers. The tenants had had to be told that they themselves must store the gas cookers and keep them in good condition. The surveyor said that the Committee would have to ask the Council whether houses could be let without gas cookers. For the life of me I do not see why they shouldn't be.

* * *

Mr. A. F. Plummer, the chairman of the board of the National Inspection Council for Electrical Installation Contracting, at the Council's annual meeting, quoted an advertisement which recently appeared in an East Anglian paper. It was from a "Do it Yourself Electrical Stores" and contained the offer:—

> "Everything to do the Job Yourself. Conduit dies and Meggers on loan. Cables, Buckle Clips, Fittings. Consumer Units 8-way, 6- and 4-way. Cooker Panels, Etc."

This goes much further in the encouragement of doubtful installation work than the mere sale of flex and accessories. But how can the N.I.C. directly do anything about it?

* * *

I suppose that I should apologise for yet another comment upon the swans of Romney Marsh who have been accused of too-frequent collisions with power lines, putting them out of action. But I cannot refrain from reproducing a verse sent by the author to the *Folkestone Herald*. This is in the true McGonagall vein and goes as follows:—

> "O noble swan why must you die
> Because of Man's electricity supply,
> The joy of seeing you in flight
> Must be taken from Marsh and Dyke."

* * *

Fifty years ago W. M. Mordey was president of the Institution of Electrical Engineers. Evidently there was at that time some disparagement of British electrical achievements and Mordey set out to refute it. His inaugural address, as reported in the *Electrical Review* of 27th November, 1908, concluded as follows:—

> "At the outset I referred to explanations given of our alleged backwardness. The backwardness does not exist; we are ahead and well ahead. I do not wish it to be thought, however, that there are no hindrances—legislative or otherwise—to our getting still further ahead. But, in my opinion, there is no more justification for the statements about our scientific and technical education being behind other countries, than for the statements about the backwardness of our electrical engineering. I resent very strongly the disparagement of the results achieved in this country by the band of teachers, eminent over the whole world, who have been responsible for the scientific and technical education of the engineers concerned in the development of our industry. Technical education should be judged, not by the wealth of the equipment of laboratories, but by the engineering results achieved in the country."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Elsewhere in this issue we report policy changes announced by the General Electric Co., Ltd., concerning valves and associated products and semi-conductors. These involve a number of executive changes. **Mr. G. A. Marriott,** director of the M.O. Valve Co., Ltd., will in future direct overall sales policy for both the M.O. Valve Co., Ltd., and for the new semi-conductor division. **Mr. A. H. Howe** has been appointed general manager of the M.O. Valve Co. and **Mr. A. K. Woodward** will continue as sales manager. **Mr. C. F. Machin,** previously chief engineer within the Semi-Conductor Department at the Wembley Research Laboratories, has been appointed general manager at Hazel Grove in charge of overall operation. **Mr. B. R. Bettridge,** hitherto in charge of semi-conductor sales in the Valve and Electronics Department, has been appointed commercial manager at Hazel Grove.

Mr. G. A. Marriott

Mr. A H. Howe

Mr. C. F. Machin

Mr. B. R. Bettridge

Mr. D. F. Ward has been appointed to the board of Barlow-Whitney, Ltd. He served an engineering apprenticeship with the British Thomson-Houston Co., Ltd., Rugby, and subsequently held appointments in the research laboratory and in the Special Valve Manufacturing Department before joining Barlow-Whitney in 1946 as technical buyer. For the last three years he has been manager of the company's Neasden factory.

London Transport announces that **Mr. A. Readman,** A.M.I.E.E., has been appointed principal executive assistant with the title of testing superintendent in the department of the chief electrical engineer. He will be responsible for testing, maintenance and development of the metering and protection equipment for the safe working of London Transport's generating stations and substations.

Mr. Readman joined the electrical staff of the Metropolitan Railway in 1932 and was transferred to the Underground section in 1934. He has been responsible for the development and commissioning of many projects, including that resulting in the development of the bus electronic scanning indicator equipment.

Reconstruction of the board of Peerless & Ericsson, Ltd., is announced following the successful bid for control of this company by Smaden Investments, Ltd. The new chairman is **Mr. J. H. Senior,** F.C.A., and the deputy chairman is **Mr. K. Wood,** who are respectively chairman and managing director of the Kenwood Manufacturing Co., Ltd. Another new director is **Mr. A. Brooking,** A.A.C.C.A., who is also a director and the secretary of the Kenwood Manufacturing Co. **Mr. W. F. Hammond** and **Mr. R. E. P. Watkins** have retired from the Peerless & Ericsson board.

Admiral Sir Ralph A. B. Edwards, K.C.B., C.B.E., has joined the board of Elliott Bros. (London), Ltd. Until he retired from the Navy this year, Sir Ralph Edwards was Commander-in-Chief N.A.T.O. Naval Forces in the Mediterranean and Commander-in-Chief Mediterranean Fleet.

On 19th November Sir Ian Horrobin, Parliamentary Secretary to the Minister of Fuel and Power, presented **British Empire Medals** at Lancaster House, London, to members of the electricity supply industry. The ceremony was attended by Sir Henry Self, chairman of the Electricity Council.

The annual dinner of the **I.E.E. East Midland Centre** was held on 19th November at the Victoria Station Hotel, Nottingham. Following the loyal toast, proposed by the chairman, Mr. D. E. Lambert, a toast to the City of Nottingham was proposed by the Centre's vice-chairman, Mr. D. H. Parry, who referred to the city and its university as a centre of electrical engineering. In his reply the Sheriff of Nottingham, Councillor F. W. Wootton, discussed the responsibilities of engineers to civic duties in addition to their more normal technical and industrial obligations.

Sir Arnold Hall, president of the Royal Aeronautical Society, in proposing a toast to the I.E.E., said that the country was largely sustained by its engineering skill, as our limited natural resources necessitated a flourishing export trade for survival. The large expenditure on technology being made by foreign powers would produce serious competition for our export markets in the course of the next few years, and it was essential that adequate investment should be made in this country for research and the development of the latest technologies to enable us to meet the coming challenge. The response was made by Mr. T. E. Goldup, past-president of the Institution, who, after giving some details of the many electrical engineering projects visited during his recent world tour, referred to the task that electrical engineers had in implementing the latest scientific achievements. A toast to the guests was proposed by the chairman, to which the reply was given by Mr.

Presentation of British Empire Medals to electricity supply employees. Front row (left to right): Messrs. R. S. Salway (S.W. Board), S. F. Lewis (S.E. Board), Sir Henry Self (chairman, Electricity Council), Messrs. A. E. Kerr (E. Board) and C. Prendergast (London Division). Back row: Messrs. J. B. Evans (Midlands Division), J. Loughlin (Yorkshire Electricity Board), D. G. Balfour (N.E. Board) and E. Ward (Yorkshire Division)

At the annual dinner of the I.E.E. East Midland Centre. Left to right: Sir Arnold Hall (president, Royal Aeronautical Society), Mr. T. E. Goldup (past-president, I.E.E.), Mr. D. E. Lambert (East Midland Centre chairman), Mr. C. R. King (deputy chairman, C.E.G.B.), Mr. J. N. Rowen (president, Nottingham Society of Engineers), Mr. L. Aldington (chairman and managing director, Aldington & Son, Spalding), Dr. W. Alexander (member of the I.E.E. East Midland Centre Committee), Councillor F. W. Wootton (Sheriff of Nottingham) and Col. W. A. Gill (junior vice-chairman, East Midland Centre)

G. B. R. Feilden, engineering director of Ruston & Hornsby, Ltd., who cited the developing nuclear engineering field as an example of the co-operation that exists between members of the various engineering institutions.

Mr. S. C. Howton, station superintendent at Barking "A" and "B," has been appointed station superintendent of the new Northfleet power station. Mr. Howton served a pupil apprenticeship under Mr. Hesketh of the Folkestone Electric Supply Co. and after four years as a switchboard attendant at Maidstone was at Bermondsey, Hornsey and Brimsdown, and with the Lancashire Electric Power Co. at Radcliffe. He came south again in 1936, joining the staff at Croydon as a charge engineer and, in 1938, he was appointed assistant operating engineer at Fulham power station. In 1949 he became group efficiency engineer in the London Division of the B.E.A., but returned to Fulham as deputy station superintendent in 1951. He was appointed station superintendent at Barking in the following year.

Mr. S. C. Howton

Mr. George Lowe, a member of the Trans-Antarctic and Everest Expeditions, addressed the boys and presented prizes at the annual prizegiving for apprentices of **Hoover, Ltd.,** at the company's Southern England group of factories, which was held at the company's Perivale headquarters on 19th November. The works manager's shield for the best apprentice of the year was won by Michael Lloyd, of Hillingdon, and the craftsmanship prize by Brian Watson, of South Harrow. The chairman of the evening's proceedings was apprentice Anthony J. Ives, of Greenford.

Mr. Derek Phillips, A.R.I.B.A., has changed his address to 1, Bovingdon Green, Herts. He will continue to practice as an architect and consultant to architects and the lighting industry from this address.

There were over 600 at the annual dinner of the **Radio Industry Council** held at the Dorchester, Park Lane, London, on Wednesday last week. Lord Brabazon, president of the Council, was in the chair and the guests included Mr. Heathcoat Amory, Chancellor of the Exchequer, Mr. Aubrey Jones, Minister of Supply, Mr. C. I. Orr-Ewing, Parliamentary Under-Secretary of State for Air and Vice-President of the Air Council, and the High Commissioners for Malaya, Australia, Pakistan and Ghana. The toast of "The Radio and Electronics Industry," was proposed by Mr. Amory, and Mr. G. Darnley-Smith, chairman of the Council, responded. The toast to the guests was proposed by Mr. Leslie C. Gamage, and the response was by Sir Eric Harrison, High Commissioner for Australia.

Miss A. M. Burns has been appointed E.A.W. organiser in the Yorkshire Area and **Mrs. E. M. Hannay** has been appointed joint organiser for Scotland.

Mr. G. L. Ball has been appointed general sales manager of Wayne Kerr Laboratories, Chessington, Surrey, and will be in charge of all sales activities in this country and abroad. Mr. Ball is a Canadian of Cornish ancestry. Before joining Wayne Kerr Laboratories he was sales manager of the components division of the Plessey Co., Ltd. He is a graduate of the I.E.E. and a member of the Incorporated Sales Managers' Association.

Mr. G. L. Ball

At the annual general meeting of the **Electrical Trades' Commercial Travellers' Association** held on 21st November at the Feathers Hotel, The Broadway, Westminster, S.W.1, the following officers were elected for the ensuing year:—President, Mr. W. J. Bird; chairman, Mr. S. Barker; vice-chairman, Mr. R. H. Corlett; secretary, Mr. J. H. Bowen; treasurer, Mr. R. Yates; subscriptions secretary, Mr. C. K. Heffernan; social secretary, Mr. F. J. Simons; employment secretary, Mr. C. F. Saunders; and Press steward, Mr. E. R. Stickley. It was decided at the meeting to make donations of £100 to the Royal Commercial Travellers' School and £300 to the E.I.B.A.

Mr. G. W. Younger, B.Sc.(Hons.), A.R.I.C., divisional scientific officer, South Eastern Division, C.E.G.B., has been appointed generation engineer in the North West, Merseyside and North Wales Region. Mr. Younger was educated at London University and commenced his career with a ceramics firm and the War Department. He joined the electricity supply industry at Barking power station as an assistant chemist. He became deputy chemist and later chief chemist at Littlebrook with the Kent Electric Power Co., and then divisional chemist in the South Eastern Division in 1948. This post was re-designated divisional scientific officer this year.

Mr. G. W. Younger

The Council of Ironfoundry Associations has appointed **Mr. F. C. Hayes,** at present education officer of the British Iron and Steel Federation, as training officer in succession to the late Mr. J. Collett. He will take up his duties on 1st December.

Mr. E. R. L. Lewis, controller of education for the English Electric group of companies, recently presented prizes to nineteen apprentices of **Marconi Instruments, Ltd.,** in the works canteen at St. Albans. Mr. Lewis was introduced by Mr. R. E. Burnett, general manager of Marconi Instruments, and among those present were the company's education officer,

Mr. J. J. Bliss, works foremen, supervisors and technicians. Before the prizegiving, Mr. Bliss gave a report on the work of the company's education department.

Mr. Brian Bromwich is relinquishing his post as chief Press officer to the General Electric Co., Ltd., to join Galitzine & Partners, Ltd., and their subsidiary, PRO Service, Ltd., as manager. Mr. Bromwich takes up his new duties on Monday next.

Mr. E. G. Parramore, the Plessey International representative in Amsterdam, has had the Knighthood of the Order of Orange-Nassau conferred on him by Queen Juliana, in recognition of his distinguished services to the Netherlands aircraft industry.

The third overseas subsidiary company of the Solartron Electronic Group, Ltd., is in the course of formation in Sweden. The company, in Stockholm, will be managed by **Mr. K. P. Källgren,** who joined the group on 1st November.

Mr. J. Drysdale, author of the article on "Tests on Narrow Insulating Tapes" (page 1015), is a member of the staff of the research laboratories of W. T. Henley's Telegraph Works Co., Ltd. He received his technical education under the company's education scheme at Gravesend and Dartford Technical Colleges. He began his career with the company in 1940 and in 1949 he joined the staff of the research laboratories. For the last 2½ years he has been in charge of electrical routine testing and investigation of insulating materials and has been associated with certain aspects of cable development.

Mr. J. Drysdale

Mr. William Fraser, B.Sc., has been elected chairman of Scottish Cables, Ltd., Renfrew, to succeed his late uncle, Mr. William Fraser, M.I.E.E. Mr. Fraser has been with the company since it was founded in 1937. He was appointed to the board in 1938 and in 1948 he became managing director, which office he continues to hold. He is also chairman of the associated company, Scottish Cables (South Africa), Ltd., Natal.

Mr. W. Fraser

Mr. J. Ritchie

Mr. J. Ritchie, C.A., who has also been with the company since 1937 as its secretary, has been elected to the board.

Mr. A. E. Henbest has been appointed London branch manager of Nettle Accessories, Ltd. He was formerly London area supervisor and will continue to operate from the London depot at 20-22, Craven Road, London, W.2 (telephone: Ambassador 3231-2).

Mr. A. E. Henbest

Four senior executives in the electrical industry were elected members of Council of the Incorporated Sales Managers' Association last week. They are **Major C. V. Wattenbach,** sales director, Dictograph Telephones, Ltd.; **Mr. S. J. Canning Matthews,** sales development director, Globe & Simpson, Sheffield; **Mr. C. H. Alger,** director, R. Alger & Sons, Ltd., Newport; and **Mr. J. P. Montgomery,** assistant chief commercial officer, Midlands Electricity Board.

Mr. S. Roberts, managing director of Hoover, Ltd., recently left London Airport for the United States at the start of a business tour of several weeks in Australia and New Zealand where he will visit Hoover establishments, distributors and dealers in Sydney, Brisbane, Adelaide and Auckland.

Mr. A. Webber has been appointed to the board of the General Cable Manufacturing Co., Ltd. He is a director of its subsidiary company, Britannic Cables, Ltd., and is general manager of both companies.

Mr. J. F. Pickup, Dip.M.I.E.S., has left the lamps and lighting division of Siemens Edison Swan, Ltd., to lecture in illuminating engineering at the Borough Polytechnic, London.

OBITUARY

Mr. A. Brookes, M.Eng., M.I.E.E., who retired from the position of special products manager with Ericsson Telephones, Ltd., in 1952, died at Beeston, Nottingham, on 15th November at the age of seventy-two. He received his early education at the newly formed Widnes Technical School (later Technical College) and later entered the University of Liverpool, where he graduated B.Eng. in 1907. He received his M.Eng. in 1918. At Liverpool he was awarded an Elder Dempster Line Engineering Scholarship and did a three-month voyage to the Gold Coast and Canary Isles, but decided against a seagoing life and soon after joined Ericsson Telephones, Ltd., Beeston, Nottingham, where he remained for forty-five years. He took an active part not only in building up and taking charge of the laboratories, but also in launching a number of the departments. His work on materials, particularly those used in the telephone industry, was outstanding and in the latter part of his career his services to the many national materials committees were invaluable. He played a prominent part in the local development of education, commencing the Ericsson apprentice scheme in 1929, and he was a senior lecturer at the University College. He had served on many of the committees of the Technical College, the Science and Engineering Advisory Committee of the University and on its Court of Governors. He was a member of the East Midlands Electricity Consultative Council. Mr. Brookes was chairman of the East Midlands Sub-Centre of the I.E.E. in 1926-27 and again in 1944-45, and took a leading part in the formation of the full Centre and was on its committee for many years.

Mr. S. Johnson, well known in the industry in connection with his work for the Electrical Industries Benevolent Association and the Electrical Trades' Commercial Travellers' Association, died on 23rd November at the age of seventy-seven. Mr. Johnson was a senior traveller for the General Electric Co., Ltd., for many years until his retirement in 1944. He was a founder member of the E.T.C.T.A., its chairman in 1937, and for many years past had been its charity steward. He was also for several years a member of the Court and of the Relief Committee of the E.I.B.A. and a governor of the Royal Commercial Travellers' School.

Mr. J. W. Grant, M.I.E.E., sole partner of James Grant & Co., 484, Pollokshaws Road, Glasgow, died on 18th November at the age of seventy. He founded the business in 1917, and specialised in the installation and repair of electric equipment in engineering establishments and in coal mines.

Mr. Edgar E. Albrow, who until his retirement in 1956 due to ill-health was manager of Green & Smith, Ltd. (Inc. Wallis & Watson), electrical contractors, Leeds, Installation Department, died on 18th November at the age of seventy-one, after thirty-five years' service.

German Retail Trade Mission

A mission representing the principal retail stores of Western Germany is visiting this country during next week, with a view to inspecting consumer goods which might find a market in Western Germany. The mission's programme will include a visit to the London Electricity Board's showrooms in Regent Street, W.1, on Tuesday next, arranged by the B.E.A.M.A.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

An Architect's Approach to Floor Heating

ALTHOUGH not surprised, I was very pleased to find that my letter in connection with Mr. Baden Hellard's excellent article, which was printed in your 14th November issue, should have drawn fire from not only the author but from Mr. E. W. Faithfull and from Mr. A. B. Hillier. I think it is fair to say that the main points of difference which this correspondence reveals are based upon opinion rather than on fact since, as I remarked earlier, with this relatively new system we all lack experience of ageing.

All those concerned are obviously anxious to produce electrical installations which are reliable, safe and economical, both in installation and running costs, and which will, by their example, convince the public that electricity is the form of energy to use. Perhaps it is in the interpretation of these terms where we differ, and in the circumstances it would seem rather pointless to pursue this aspect of the matter, the answer to which only time and experience will reveal.

I would like, if I may, to make just one general comment. As I understand it the cost of a normal electrical installation to a flat or maisonnette is about 2 per cent of the total cost. I know, of course, that floor heating would lift this percentage considerably, but this capital cost, whether covering the embedded or withdrawable system, would be less than for other forms of heating. When one considers that electricity is such a vital commodity, which must be installed in such a way that it is completely safe for those who have to use and control it, this seems to me to be a very small percentage indeed.

In my opinion we, in this country, tend to over-economise on electrical installations, particularly when one takes into account the rapid increase in the use of electrical aids and accessories, and that in the United States it is normal practice for 65 outlets to be provided in a six-room house and about 45 in a two-bedroom mass-produced economy house.

London, S.W.1. S. L. M. BARLOW.

Tests on a Washer

A SERIES of tests with the "Merlin" washer was recently carried out by *Which* (the magazine of the Association for Consumer Research). The conditions under which these tests were conducted produced results based on the effect of the "Merlin" on test pieces of material, which had previously been subjected to soiling by a solution to a standard laid down by the British Launderers' Research Association. The results of these tests suggested, in the opinion of *Which*, that the appliance had no significant washing action.

It will be seen that the test depended upon the quality and contents of the soiling solution. In my opinion this bore no resemblance to actual day-to-day soiling of materials as experienced by the housewife. I hold this opinion because, in using materials soiled in the normal way, there is no doubt whatsoever in the mind of the public to whom the "Merlin" has been demonstrated (these demonstrations to date total some 375, in all parts of the country, over a period of two years) that the washer is a very effective machine indeed.

However, the results of the *Which* tests were published in the summer issue of the magazine, and I subsequently invited their staff to witness washing tests carried out using methods similar to those employed in the demonstrations to the public referred to above. These tests showed, beyond all reasonable doubt, that the washer does achieve the results claimed for it. In fact, subsequent to the latter tests, members of the general public were asked by the staff of *Which* to judge the relative cleanliness of two pieces of material, one washed with the "Merlin," the other soak-washed without using the appliance.

The results of these inquiries, collated by *Which*, were that 51 per cent of the women approached judged the "Merlin" washed sample to be the cleaner; 24 per cent considered the soak-washed sample to be the cleaner; and 25 per cent advanced no definite opinion. These answers by housewives are surely significant.

A further criticism I have to make of the *Which* tests is that they were not conducted in a manner to show advantages peculiar to the "Merlin." Because there is no direct agitation of the materials themselves during washing, the most delicate fabrics, including woollens and nylons, can be washed without any possibility of damage resulting. This advantage alone has proved a very high selling factor when it has been demonstrated.

Let me say that I am convinced of the sincerity of the staff of *Which* and, in fact, was very favourably impressed by their desire to carry out a fair test. The fact that they did not do so originally was simply, to my mind, a result of their lack of experience of what housewives actually require in a washing machine.

London, S.W.1. J. A. FRASER,
Managing Director,
New Day Electric (Sales), Ltd.

Why No Clocks?

WHY is it that when we see photographs of new buildings and interiors of the buildings, we very seldom see a clock in the picture?

In your last few issues you have shown us some of the most up-to-date premises in the country, but not one in twenty shows a clock. Surely in this very time-conscious age people still want to see the time. Or is it that architects have not been able to find the right clock for the job? A clock should be as an essential part of the equipment as, say, the lighting or the office desk and the heating system, and not everybody carries a watch.

Most electric clock firms are willing to advise on clock systems and the design of clocks when the job is at the drawing board stage.

London, E.C.1. F. STEVENS,
Technical Manager,
"Gibson" Clock Division,
Baume & Co., Ltd.

Engineering Centre

Because of the implication that its permanent exhibition is confined to Birmingham firms, the Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham, 2, has changed its name to "The Engineering Centre." This in no way affects the structure or operation of the organisation.

Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

INVESTIGATIONS have been carried out on an experimental line span, 340 m long, in which the number and arrangement of the grouped phase conductors could be altered. Two earth wires were provided, the height of suspension of which could also be varied. The voltage supply was by a group of 500 kV/250 kVA single-phase transformers. A special meteorological station was set up to obtain continuous accurate records of atmospheric conditions. The losses were measured by wattmeter equipment the sensitivity of which was improved by compensating the charging current of the line, and also by compensating for the capacitance and other error sources in the measuring circuit itself.

During the long period of measurements (two years) the effects of all kinds of atmospheric conditions on corona could be observed; however, the author emphasises that the fact that the line was " cold," i.e. not really operating, must make some difference, especially under precipitations and with snow and ice deposits. Great care was taken in the evaluation of the results which showed considerable dispersion, often without any apparent reason.

It was found that the variations of the density of the air have a greater effect on the curve of the corona losses than precipitations and the author suggests, therefore, basing the average values of the losses during the hot and cold seasons on average air densities during these seasons. A simple method of calculating annual corona losses is presented. Estimates of the annual corona losses for the lines Stalingrad-Moscow, Kuibyshev-Moscow and Kuibyshev-Sverdlovsk, for operation at 420 and 500 kV are given. — " Corona Investigation on A.C. Lines Operated at 400 kV and Higher Voltages," N. P. Emelyanov, *Elekt. Stantsii*, No. 7, pp. 60-67, 1958, in Russian.

Capacitor Bushing Design

The paper is prefaced by a brief account of the production technology of phenolic-bonded paper bushings and then describes the basic types of French 245 kV bushings forming the starting point for the development of bushings for higher voltages. The three basic voltage levels determining the design of the bushings are then discussed, viz. ionisation level, impulse flashover withstand level and flashover level in oil at the commercial frequency. Fundamentals of the calculation of bushings are given, first for uniform axial potential gradient, yielding the equation of the meridian section, with which it is easy to obtain the radial gradients.

The choice of the optimum radial dimensions for the actual design follows from the data now available, as also the number, lengths and diameters of the electrodes. The 420 kV bushings of the French grid are then described with all their distinguishing features and test results obtained on them are given. Photographs taken during the tests show certain discharge phenomena observed during initial test stages, and their eventual suppression by simple means.—" Progress in the Construction of V.H.V. Dry-Type Capacitor Bushings," L. Blumental, *Bull. Soc. Franc. Elect.*, 7th ser., Vol. 8, No. 91, pp. 422-434, July, 1958, in French.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

Commutation Process Phenomena

In recent years many phenomena accompanying commutation processes in commutator machines were discovered and investigated. These phenomena, of ionic, electro-chemical, thermal and mechanical character, can now be definitely excluded as factors of decisive influence on the development of the commutation process under brush contacts. This confirms the enduring usefulness of Arnold and Mie's classic theory of commutation (now 60 years old).

A slight modification can and must now be introduced into the fundamental equations to adapt them to the physical character of the conductivity phenomena under the brushes which they describe. After this transformation the formal integration of the differential equation of the commutating current, on the assumption of constant reactance voltage, yields an integral which is representable by incomplete beta-functions which have been tabulated, but only for part of the range required. Known expansions of the complete beta-function yield after some transformations a useful convergent expansion for the incomplete beta-function in the range required. This solves the problem of calculating not only the commutating current, but also the ampere-turns of the commutating armature reaction and obtaining a realistic value of the mean reactance voltage.—" Analysis of the Commutation of Commutator Machines on the Basis of Contact Conductivity," M. I. Romanov, *Dokl. Akad. Nauk SSSR*, Vol. 121, No. 2, pp. 284-287, 1958, in Russian.

Heat Flow Models

The author has previously published a method of modelling unsteady heat flows in electric machines and applied it to a thermal two-body system. The present paper is a sequel to the first communication and deals with more complicated cases of unsteady heat flow in the armature of electric machines. A bar with fixed temperatures at the ends as the main element of a winding serves as an example for a demonstration that the problem of the unsteady heat flow may be solved either by Fourier's equation or by an electric analogue of the bar (a recurrent network). The principle and the advantages of the " dual " representation are also explained. Modifications of the basic problem according to the different methods of heat dissipation are treated as well as the analogous processes in the steel core of the armature and in the ventilating ducts.

After these preparations it is possible to design, first, a complete thermal circuit of an electric machine for cooling by air of constant temperature, with its electric analogue and " dual," and then the corresponding circuits, considering the temperature variations of the cooling air during its passage through the machine. The actual measurements are oscillographic current measurements in the various branches of the modelling circuits which, on a temperature scale, yield the temperature distribution and, eventually, the time relation of the temperature rises at the sensitive points of the machine.—" Electric Models of the Unsteady Heat Flow in Electric Machines," F. Provaznik, *Elektrotech. Obzor*, Vol. 47, No. 4, pp. 184-193, 1958, in Czech.

INDUSTRY AND THE HOUSE

Debate on Compulsory Arbitration

By A. M. F. PALMER, A.M.I.E.E., M.Inst.F., M.P.

A FAIR number of topics much affecting industry are now pushing their way into Parliamentary debates. For instance, there is the intention of the Minister of Labour to drop compulsory arbitration, also some limited proposals for new factory legislation and the long-awaited statement about the strip steel mills.

On compulsory arbitration the Government thought, I imagine, that this system could be dropped without too much bother apart from routine gestures by the Opposition. However, it seems that compulsory arbitration has won quite a warm place in the affections of groups of employees not normally regarded as typical trade unionists. Among the loudest in their agitation against the Government's policy are the local government employees in N.A.L.G.O. and the bank clerks—now very militant in their own independent trade union. These salaried workers argue that it is against their practice and tradition to strike, a weapon which for the manual trade unionists often helps to provide the very final arbitration —that of force. Hence, the opportunity to take a recalcitrant employer to an impartial board and compel him to pay the correct rate of salary—decided after objective assessment—is, they contend, a tremendous asset to the blackcoated worker.

The Government's case in the Commons debate was put clearly enough by Mr. Macleod, the Minister of Labour. He said the Opposition had not bothered to look at what was the Government's central dilemma. If the two sides of industry held fundamentally differing views on a question, should any Minister of Labour impose something which one party did not want ? Should he not instead be sensible and recognise that real success could rest only on agreement ?

During the war, and in the years immediately following, compulsory arbitration had played a real and valuable role. But Mr. Macleod did not see compulsory arbitration playing that part in the future, for the determining factor must always be what industry truly felt itself. At any rate, revocation would have the beneficial effect of making possible easier working of the voluntary system. The Industrial Court, which dealt now with a mere 40 cases a year, might have a heavier load to carry. The Minister made special reference to the local government situation. He said that N.A.L.G.O. had discussed their problems with his department and he understood they were to have talks with the local authority associations as well. Mr. Macleod denied hotly the suggestion that employers were now taking a tougher line because, with mounting unemployment, they thought they were in a stronger position to do so.

Annulment Opposed

Opening the debate, Mr. Robens, a former Minister of Labour, who always speaks with penetration on what are matters close to his heart and experience, said it was not part of the Opposition's case that the employers had no right to put their views to the Minister. Yet they still hoped the Minister would have second thoughts about the annulment of the compulsory arbitration procedure. The employers had said it was one-sided. It had also been said that the trade unions had refused to appear before tribunals. In fact, there were four such cases. Putting aside all theories, there were not enough practical arguments given for ending a system under which over 1,000 disputes had been satisfactorily settled.

A longish debate ensued in which the speakers were mainly trade unionists from the Labour benches and employers of labour from the Conservative side. An exception was Mr. Mawby, an ex-electrician who represents the rural Conservative fastness of Totnes. He supported the Government, but thought that much more could be done to " build-in " arbitration in employer-employee relationships. Miss Elaine Burton, who sits for Labour in Coventry South, brought a message from that great industrial centre to the effect that local government authorities and trade unions there were united in opposition to the Government's plan. A number of the local employers were also opposed, she said.

The Conservatives held their own in the division that ended the debate, with a majority of 66.

Proposed New Strip Mills

At long last the Government have announced a decision on the large steel strip mill projects. One new mill is to be in South Wales and the work undertaken by a still nationally owned firm, Richard Thomas & Baldwin, at Newport. The other mill will be in Lanarkshire, Scotland, and run by Colvilles. Altogether, the effect will be to increase national strip steel production from 4,500,000 tons per year to 8,500,000 tons; to start with, each of the developments will produce 500,000 tons.

The political implications of the decision were made clear when the Prime Minister came forward himself to make the announcement in the Commons, not leaving it to Lord Mills as the directly responsible Minister in the Lords. It is said that there was much lobbying behind the scenes—with pressure groups very active—before the Government in the end agreed to compromise and give something to both Scotland and Wales. Conservative back benchers, Scottish and Welsh, were well pleased with the announcement. But Scottish Labour members felt that because of Scotland's extremely high unemployment figures, they should have had the lion's share. To this the Prime Minister answered that even the initial Lanarkshire capacity would supply more than the total present Scottish need and, he hoped, bring to Scotland new steel-using industries.

In this matter the Government have probably gone about as far as they dare go in putting regional political considerations before hard economic facts. When all is said and done, South Wales is obviously closer to the great strip steel using industries of the Midlands than Scotland. However, as I have pointed out before in these columns, politics which reflect human desires and prejudices will always on occasion override cold figures and a General Election is just around the corner.

The Factories Bill proposes to compel the Minister of Labour to promote safety, health and welfare measures in industry in a positive fashion and to bring about greater security in fire precautions. There have been, of course,

in the last few years two disastrous factory conflagrations: the mill fire at Keighley and the Coventry Jaguar fire.

On Second Reading there was a good constructive debate, the point being made constantly that the Minister should have used his opportunity to bring in other overdue improvements in industrial safety. The writer instanced the need for a new approach to safety on electrical power systems with the now vast growth of plant capacity and higher voltages.

Electricity Council Scholarships

TO ensure that the electricity supply industry continues to meet all the demands made upon it, it is essential for it to receive the best brains now in the schools. Accordingly, the industry has launched a new scheme for providing university scholarships for sixth formers. Under the scheme young men without outstanding school records (a good Ordinary Level G.C.E. with passes which include English and three Advanced Level G.C.E. passes including mathematics and science are the minimum requirements) may be awarded university scholarships after interview. These will be worth £450 a year at Oxford and Cambridge and £400 a year at other universities and will enable students to attend a university to read for degrees in engineering and science. Up to three scholarships intended mainly for electrical engineers are to be awarded by each of the twelve Area Boards, and twenty-five intended for scientists and engineers by the Central Electricity Generating Board. The scheme is being co-ordinated by the Electricity Council which represents the industry as a whole.

Italian Nuclear Power Station

THE beginning of work on the first commercial-sized nuclear power station in continental Europe was marked last week by a ceremony on the site near Latina, 40 miles from Rome. In the presence of Lord Mills, Minister of Power; Signor Bo, Italy's Minister for Industry and Trade; and Sir Claude Gibb, chairman of the Nuclear Power Plant Co., Signor Mattei, chairman of A.G.I.P.-Nucleare, for which the station is being built, dropped a cylinder containing a commemorative document into one of the first batches of concrete, which was then tipped into a prepared trench.

The 200 MW station, which is based on the plant now being built at Bradwell, is expected to be completed in 1962, and about one-half its total cost (estimated at £20 million) will be spent in Italy. The Nuclear Power Plant Co. is responsible for the overall design of the station and for its satisfactory commissioning. It will also supply the major components including the reactor and heat transfer elements. A.G.I.P.-Nucleare will undertake the civil engineering and building work and will be responsible for the manufacture and testing of all components to be made in Italy. The customer for the station is the Societa Italiana Meridionale per d'Energia Atomica (S.I.M.E.A.) which is owned jointly by A.G.I.P.-Nucleare and the Institute per la Riconstruzione Industriale (I.R.I.).

Specification

The reactor of the Latina station is of the natural uranium, graphite-moderated, gas-cooled type and the core, which is 14·5 m in diameter by 9·45 m high, contains 2,980 fuel channels and 100 control rod channels. The total uranium charge is 275 tonnes, the maximum average thermal flux in the moderator $2{\cdot}3 \times 10^{13}$ /cm² sec and the mean uranium rating 2·5 MW/tonne. The reactor has a heat output of 705 MW.

The Italian Prime Minister, Signor O. A. Fanfani, speaking at a dinner given by the Nuclear Power Plant Co. in Rome last week. Lord Mills is on the left and Sir Claude Gibb on the right

There are six coolant circuits, with a total blower power of 19 MW, and the gas temperature is raised from 180 deg C at the inlet to 390 deg C at the outlet. The steam temperature is 373 deg C and the pressure is 52·4 atm abs in the high-pressure circuit and 14·3 atm abs in the low-pressure circuit. There are three main 70 MW, 3,000 r.p.m. turbo-alternators.

At a dinner in Rome last week Sir Claude Gibb said that the main point of contention in the choice of a thermal reactor system was whether to use natural or enriched uranium as a fuel. The adoption of an enriched fuel would mean a country tying itself to one source of supply. Natural uranium fuel for the Latina station would be supplied initially from Britain and though it was probable that uranium concentrates could be produced from South African and Canadian ores more cheaply than from Italian ore, an Italian plant could be installed relatively quickly if required. As a result of the collaboration between the Nuclear Power Plant Co. and A.G.I.P.-Nucleare, he said, Italian industry would learn how to construct more and more of each successive nuclear power station.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton	£180 0s 0d
COPPER, H.C. Electro	ton	£225 5s 0d
Fire Refined 99·70%	ton	£224 0s 0d
Fire Refined 99·50%	ton	£223 0s 0d
COPPER Tubes	lb	2s 2½d
Sheet	ton	£257 0s 0d
H.C. wire and strip	ton	£285 15s 0d
LEAD, English	ton	£74 5s 0d
Foreign	ton	£73 0s 0d
MERCURY	flask	£74 0s 0d
TIN, block (English)	ton	£755 0s 0d
ZINC, G.O.B. Foreign	ton	£75 5s 0d
BRASS Tubes (solid drawn)	lb	1s 9½d
Wire	lb	2s 7½d
PHOSPHOR BRONZE Wire	lb	4s 0d
PLATINUM	oz	£19 10s 0d
RUBBER, No. 1 R.S.S. spot	lb	25½d—25½d

OVERSEAS ELECTRICAL TRADE

Marked Recovery in Exports During October

BOTH exports and imports of electrical goods rose sharply during October, which is traditionally one of the busiest months for overseas trade. The downward trend in exports since July was arrested last month by an increase of £4·2 million over the September total. The October total of £19·1 million was also an advance of £1·3 million on that for October last year.

Shipments to the United States at £1·2 million were two-and-a-half times above the September figure and were the highest for the year. The rise in exports to Canada was less marked, but nevertheless the shipments to these two countries last month accounted for 12·5 per cent of the October exports. The ten months' total of £17·6 million was, however, £4·5 million less than for the same period last year. There was a further increase in exports to Venezuela, and the month's total of £400,000 was £100,000 above that for October, 1957.

Imports rose by £690,000 to over £2·9 million and the total for the ten months of the year was £21·1 million, £1·8 million more than in the corresponding period of

TABLE I.—ELECTRICAL EXPORTS

Class	Month of October, 1958	Ten months ended 31st October, 1957	Ten months ended 31st October, 1958
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	97,066	1,446,579	1,154,831
Ditto, 10 to 65 kW	159,547	1,697,241	1,960,022
Ditto, 65 to 200 kW	110,997	1,155,514	1,877,007
Ditto, over 200 kW	297,233	3,322,735	4,056,094
Spark ignition engine driven	6,875	174,029	153,687
Steam turbine driven	1,768	679,088	684,437
Hydraulic turbine driven	—	79,167	17,542
Other prime mover driven	12,186	240,522	168,608
Generators, not exceeding 200 kW	67,026	1,560,416	1,251,591
Ditto, over 200 kW	36,607	1,339,899	944,122
Parts of generators	1,050,703	3,604,388	6,969,322
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	177,067	1,955,100	1,537,352
Over ½ but under 1 h.p.	40,836	501,137	479,317
1 h.p. to 250 h.p.	430,852	4,712,095	4,458,631
Over 250 h.p.	213,237	1,332,972	1,238,776
Railway, tramway and trolley-bus motors complete and parts of all motors	210,409	2,008,311	2,111,901
Motor starting and controlling gear	311,848	3,272,574	2,576,898
	3,224,257	29,081,767	31,640,138
Converting machinery	38,286	448,175	296,744
Mercury-arc rectifiers	92,400	1,237,754	1,051,171
Transformers for lighting, heating and power (incl. coils):			
Not exceeding 7,500 kVA	413,081	5,972,837	5,933,107
Over 7,500 kVA	573,090	2,787,239	4,356,099
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	445,253	3,632,707	4,048,973
Ditto, other	1,006,137	11,560,776	10,026,617
	2,568,247	25,639,488	25,712,711
Primary batteries:			
Lighting	105,884	991,891	905,561
Radio	330,779	2,442,149	2,988,264
Other	34,119	399,068	446,391
Parts (excl. carbons)	49,014	563,822	471,102
Lamps:			
Filament, exceeding 28 V	84,371	899,983	825,026
Ditto, under 28 V	39,247	288,587	301,359
Arc lamps and searchlights	24,269	122,504	185,836
Discharge lamps, fluorescent tubes, etc.	107,169	938,326	871,822
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	28,157	217,032	270,850
All other	481,152	2,940,950	3,713,080
Parts (excluding glass bulbs)	26,711	135,889	211,149
Radio and television transmitters	118,653	601,541	349,671
Commercial radio and radar equipment	1,387,232	12,960,258	11,900,894
Domestic radio receivers, mains	99,884	1,080,007	849,485
Ditto, battery	62,382	554,431	521,335
Ditto, other (incl. car)	39,765	270,800	232,684
Radiograms	48,015	320,662	341,250
Television sets	85,539	556,531	897,363
Public address equipment	86,383	921,153	902,650
Other radio and television apparatus, n.e.s.	41,819	407,711	348,269
Components and parts, n.e.s.	720,009	7,949,102	7,393,085
	3,225,701	28,916,067	27,931,765
Telegraph and telephone installations	772,574	7,312,395	7,437,280
Telephone instruments, separately consigned	78,514	1,491,133	1,567,265
Telegraph and telephone parts	813,886	7,884,676	7,828,198
Line apparatus for long distance communication	128,360	2,019,850	1,717,860
	1,793,334	18,708,054	18,550,603

Class	Month of October, 1958	Ten months ended 31st October, 1957	Ten months ended 31st October, 1958
	£	£	£
Cookers	54,697	645,555	575,738
Toasters	28,515	219,742	239,800
Other cooking apparatus	27,564	330,662	323,756
Parts and accessories	89,398	650,645	638,853
Space heating appliances	50,046	353,921	328,111
Water heating appliances	31,920	319,548	267,864
Other heating appliances	22,277	329,127	294,587
Parts and accessories	94,897	557,063	691,727
Irons	72,851	778,435	741,232
Arc welding equipment, a.c.	29,116	510,895	460,558
Ditto, d.c.	44,264	437,866	749,531
Resistance welding equipment	13,618	225,314	141,182
Electric furnace plant	107,844	757,926	989,672
Magnetos, ignition	15,802	225,935	146,562
Sparking plugs	151,266	1,625,213	1,497,106
Elec. appliances for aeroplanes, n.e.s.	355,666	2,698,376	2,845,975
Ditto, for motor vehicles, n.e.s.	463,113	3,411,784	3,850,204
Ditto, for cycles, n.e.s.	51,749	549,427	532,946
Signalling app. (incl. traffic signals)	204,529	1,206,811	1,420,824
Instruments, commercial	157,143	1,668,986	1,726,450
House service meters (including parts)	173,486	1,428,328	1,471,863
Electro-medical apparatus (not X-ray)	31,105	377,565	520,971
X-ray apparatus (excl. tubes and valves)	56,220	722,646	546,643
Vacuum tubes	41,963	411,322	463,776
Ceiling fans, complete	94,806	1,051,307	1,035 769
Desk fans, complete and parts of desk and ceiling fans	31,063	407,316	321,799
Vacuum cleaners	113,755	1,472,695	1,242,661
Floor polishers	80,721	865,369	687,256
Food mixers	61,236	529,082	563,108
Hair clippers and dry shavers	75,995	695,767	555,989
Other portable appliances	17,272	262,229	178,182
Parts	113,198	1,352,195	1,065,656
Portable elec. tools (not saws) and parts	207,671	2,162,854	2,064,873
Cables and wires:			
Telegraph and telephone, submarine	55,178	4,266,234	681,665
Ditto, other	519,321	9,367,291	5,195,843
Cotton, silk or art. silk insulated	39,301	358,832	423,911
Enamel, glass or asbestos insulated	174,638	914,513	1,045,176
Paper insulated	533,314	7,559,565	6,459,978
Rubber insulated	367,593	5,336,228	4,382,020
Thermoplastic insulated	187,722	1,879,654	1,905,861
Other	262,692	1,721,382	2,217,403
	2,139,759	31,403,699	22,311,857
Accumulators for motor vehicles	116,612	1,524,914	1,515,381
Ditto, traction	24,347	273,514	199,973
Ditto, radio and other portable	44,143	627,923	579,654
Ditto, other	26,487	314,216	319,643
Parts and accessories	75,465	823,868	922,756
Electric wiring accessories	197,802	569,609	1,748,163
Elec. porcelain, etc. (incl. insulators), n.e.s.	98,921	1,005,180	1,037,864
Insulating cloth and tape	50,243	554,507	490,729
Other insulating material	99,619	949,059	976,590
Permanent magnets	33,329	518,726	471,317
Radio, telegraph and telephone testing equipment, n.e.s.	105,630	643,939	721,485
Scientific elec. instruments (not telegraphic or telephonic):			
Time recorders and time switches, complete	33,883	122,979	308,426
Other	301,092	3,016,662	3,548,342
Electrical machinery, n.e.s.	94,442	937,053	807,365
Electrical apparatus and appliances, n.e.s.	925,494	8,598,009	8,480,972
TOTAL	19,118,425	190,117,469	184,452,319

TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	Month of October, 1958	Ten months ended 31st October, 1957	Ten months ended 31st October, 1958
	£	£	£
Channel Islands	115,877	931,237	1,160,748
Gibraltar	29,154	207,177	280,304
Malta and Gozo	34,742	612,778	589,532
Cyprus	28,382	1,292,711	705,251
Sierra Leone	36,245	359,616	550,184
Ghana	171,629	1,630,472	1,513,179
Nigeria	446,928	2,743,712	3,685,294
Union of South Africa	1,399,155	14 689,433	15,826,861
Rhodesia and Nyasaland	531,378	4,949,659	4,388,941
Tanganyika	43,523	725,289	461,242
Kenya	146,269	2,266,026	1,317,789
Uganda	52,707	826,003	546,213
Mauritius	44,185	345,452	379,507
Aden	72,510	444,894	547,888
Bahrain, Qatar and Trucial States	48,842	1,374,008	888,425
Kuwait	173,742	2,669,844	1,663,535
India	1,652,038	19,016,290	15,273,455
Pakistan	162,607	2,527,079	2,160,180
Singapore	319,719	3,334,520	3,163,141
Federation of Malaya	330,910	2,765,486	2,908,140
Ceylon	124,277	1,469,661	1,529,620
British North Borneo	27,507	241,631	196,701
Sarawak	23,545	211,616	231,094
Hong Kong	375,533	2,478,340	2,949,646
Australia	1,770,028	17,139,138	15,925,113
New Zealand	1,147,942	9,660,415	11,181,642
Fiji	48,569	168,710	286,700
Canada	1,229,407	10,831,210	11,693,774
Jamaica	144,417	1,094,742	1,381,721
Barbados	21,462	172,171	252,171
Trinidad	180,255	1,120,421	1,180,258
British Guiana	110,080	425,524	698,574
Other Commonwealth countries	230,424	1,163,714	1,603,420
Irish Republic	321,225	2,248,164	2,854,016
Soviet Union	55,643	1,901,120	504,497
Finland	85,503	1,375,630	1,130,560
Sweden	507,268	3,998,866	4,461,398
Norway	167,446	2,198,708	2,022,694
Denmark	155,126	1,835,399	1,852,071
Poland	20,477	523,421	653,369
Western Germany	341,513	2,092,599	2,892,047
Netherlands	678,895	6,664,867	6,154,849
Belgium	452,807	3,076,634	2,796,366
France	281,877	3,546,757	3,256,440
Switzerland	121,438	1,218,758	1,637,448
Portugal	142,801	2,748,662	2,742,856
Spain	311,340	3,336,282	1,685,348
Italy	208,205	3,289,599	2,701,133
Austria	53,057	402,825	458,810
Yugoslavia	43,209	535,613	624,007
Greece	77,417	1,207,928	808,472
Turkey	34,264	738,873	992,849
Belgian Congo	22,186	456,242	353,366
Portuguese East Africa	21,999	273,863	221,406
Egypt	56,432	133,602	932,016
Libya	62,711	382,905	580,968
Southern Morocco	52,132	346,382	388,373
Sudan	39,098	1,020,260	894,498
Syria	35,388	271,735	285,062
Lebanon	31,237	433,648	440,556
Israel	144,440	585,033	1,026,220
Jordan	168,852	494,015	745,563
Saudi Arabia	43,708	468,931	729,082
Iraq	165,498	2,388,858	2,677,067
Iran	283,247	3,559,561	3,363,266
Burma	118,459	979,327	761,355
Thailand	69,749	870,262	1,127,074
Indonesia	26,322	478,543	284,815
Japan	16,843	714,933	426,269
United States of America	1,207,229	11,337,232	7,035,508
Cuba	51,168	630,850	693,405
Mexico	61,347	543,887	495,341
Colombia	39,881	557,409	343,891
Venezuela	399,421	2,968,130	4,007,310
Peru	33,339	564,849	416,129
Chile	48,111	424,788	502,366
Brazil	51,989	1,025,402	890,668
Uruguay	27,672	225,506	63,499
Argentine Republic	71,333	1,321,388	3,382,288
Other foreign countries	435,135	3,830,244	4,035,485
TOTAL	19,118,425	190,117,469	184,452,319

last year. The main increases in October were in imports of motors, welding machinery and electro-medical apparatus.

Increases over the September figures are recorded for exports of all the main classes of electrical goods, but only in the rotating machinery and converting and switchgear groups are the totals for the first ten months of the year above those for the corresponding period of last year.

The leading market for generating sets and motors in October was the United States, to which plant worth £682,659 was shipped. Next in order of importance were Canada (£291,999), India (£285,152), Australia (£271,101), and South Africa (£226,256). The largest shipments of converting machinery, transformers and switchgear were made to South Africa (£392,895) and to India (£320,567).

The Netherlands as the best market for radio and associated equipment (£332,428) was closely followed by Belgium (£305,901), while outside Europe the largest shipments were made to the United States (£258,327). Telegraph and telephone material was sent mainly to Australia (£313,588), New Zealand (£235,586), and South Africa (£153,740).

Exports of wires and cables to the United States again declined and were valued at £22,615 compared with £326,090 in October last year. The best market was India (£353,512), followed by New Zealand (£165,429), Hong Kong (£143,855) and Singapore (£136,543).

In addition to the goods shown in Table I, with their distribution in Table II, the Board of Trade returns include the following classes of electrical equipment in other sections:—

Electric locomotives: October, £359,399; ten months (January-October), £2,848,169 (against £3,155,190).

Locomotives with i.c. engines and electrical transmission: October, £82,800; ten months, £1,614,808 (£2,806,054).

Electrically-operated washing machines, complete, not exceeding 150 lb net weight: October, £257,795; ten months, £3,334,389 (£2,818,309). Ditto, 150-250 lb: October, £73,519; ten months, £781,938 (£961,907). Parts: October, £142,056; ten months, £820,860 (£578,279).

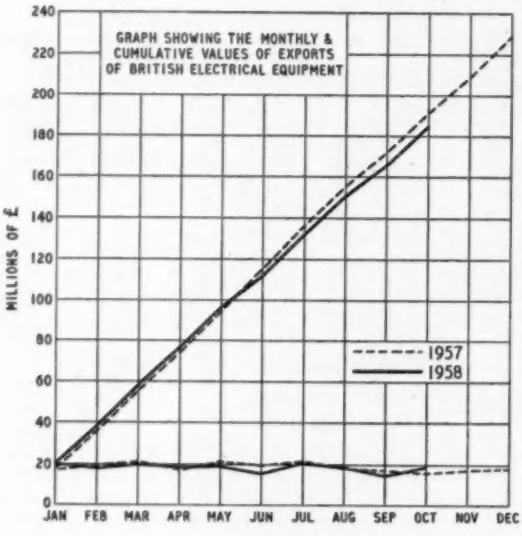
Welding electrodes: October, £107,236; ten months, £1,153,026 (£1,133,367).

Electric conduit tubes and cased tubes: October, £47,593; ten months, £563,980 (£708,695).

Electric carbons (including parts): October, £42,421; ten months, £505,260 (£538,333).

Electric lighting fittings and lanterns (excluding arc lamps, searchlights, and lamps for road vehicles): October, £272,044; ten months, £2,792,572 (£2,037,728).

Other electric lighting appliances (excluding vacuum tubes and lamp bulbs) and fittings and parts n.e.s.: October, £22,148; ten months, £407,560 (£2,253,237).



Group Training Apprenticeships

REPORT OF CONFERENCE HELD LAST WEEK AT THE INSTITUTION OF ELECTRICAL ENGINEERS

A ONE-DAY conference on group training for graduates and student apprentices was held last Friday at the Institution of Electrical Engineers. It was opened by Mr. S. E. Goodall (President I.E.E.), who welcomed the 140 representatives of firms and technical colleges attending the conference. The programme consisted of three short lectures in the morning and an open discussion at the afternoon session.

The first lecture, given by Sir Willis Jackson, was on the nature of the training problem and the need for extended training facilities. He estimated that by the mid-1960s the number of undergraduates reading engineering would be double the present figure. This would produce about 1,500 graduates per annum in electrical engineering alone. With regard to student apprentices, that was those pursuing a sandwich course, Sir Willis Jackson thought that there would be between 1,000 and 1,500 taking the Diploma in Technology (Engineering) by the mid-1960s. The purpose of the conference was to consider the facilities available for the practical training of graduates and student apprentices, who would reach a total of 2,500 to 3,000 per annum in the mid-1960s.

Scottish Scheme

Mr. J. E. C. McCandlish told the conference about the group training of graduates in the S.E.T.S. (Scottish Electrical Training Scheme). This scheme covered six firms, the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board. Two of the firms, Bruce Peebles and Harland Engineering, were engaged in heavy electrical engineering; two others, Belmos and Honeywell Controls, manufactured light current equipment; and the remaining two were Scottish Cables, Ltd., and the contracting firm of James Kilpatrick. There were now 120 men under training. Graduates entering the scheme, at present limited to British subjects, joined S.E.T.S. and not individual member firms. At about the middle of the course, the trainees were asked which firm they wished to join and they then entered into a written agreement with the firm of their choice to remain in that firm's employ for at least a year after completing their training.

The scheme was financed by a type of "payment-by-results." The cost of training a graduate was charged to member firms when the trainee joined the firm of his choice. Overhead charges, such as the cost of S.E.T.S. office, wastage, etc., were added to the basic training costs. One of the many advantages of the scheme was that the trainees had the opportunity of seeing how different firms tackled the same kind of job. Six essential points for the formation of a group training scheme were then enumerated by Mr. McCandlish.

Group training was first proposed by the Engineering Industries Association in 1953 and Industrial Administration (R & A), Ltd., were invited to prepare a report. A pilot scheme was operated in 1954 and as a result the Engineering Industries Association Group Apprenticeship (E.I.A.G.A.) was formed. Mr. K. M. Ward, of E.I.A.G.A., gave a talk on group training of student apprentices and he described the operation of E.I.A.G.A. There were 200 member firms and 350 apprentices of all types, except graduates, were at present in training.

The difficulties of training in a specialised firm were described by Mr. F. O. Morrell, of the Automatic Telephone & Electric Co., Ltd. A group training scheme had been formed in 1953 to overcome these difficulties and was independent of the three participating firms. Mr. Morrell said that the additional cost of giving an apprentice a broad training instead of a "one-firm" training amounted to only about £60 to £80 per man and was cheaper than advertising for a trained man.

Problem of the Small Firm

The discussion was opened by the I.E.E. President who pointed out that an apprenticeship was not just an extra hurdle for the prospective professional engineer but was an essential part of his training. The major difficulty in starting a group training scheme was to persuade the directors of small firms that practical training was a necessity. Mr. Goodall thought that such a scheme could not be run properly unless it was set up as an independent body.

Sixteen people took part in the discussion, six from technical colleges, five from large organisations, four from small organisations who had solved their training problems and one speaker on behalf of Industrial Administration (R & A), Ltd. One major point brought out was that the better students always wanted to go to the large electrical engineering concerns which were renowned for their training schemes. Another speaker felt that too many people would be trained as electrical engineers and they might not all be absorbed in industry after training. Some firms obtained fully trained men by attracting them by higher salaries away from the firms that had trained them. One speaker said that adequate training facilities were becoming a problem; something had to be done now and not left until the mid-1960s. Far too many firms were only thinking of the cost of training, day release, etc., and were not looking ahead sufficiently. An estimate of £2,500 as the cost of training one man was given by a speaker. One solution might be a Government subsidy.

Replies to Questions

In reply to some questioners, Mr. McCandlish said that S.E.T.S. operated a system of "uncles," junior engineers being detailed to look after apprentices. All the apprentices were paid monthly. With regard to the possibility of leakage of secret processes to other firms via the apprentices, he said that if a firm wanted to know its competitors' secrets, there were other easier ways and means. On costs, Mr. Ward said that the figure was about £1,500 over five years excluding the wages of the apprentice. Sir Willis Jackson said that the large firms were now training the maximum number of apprentices they could afford. In Metropolitan-Vickers, 12 per cent of the total number of employees were apprentices. This figure could not be increased.

Closing the conference, Mr. Goodall said he hoped that small firms would form group training schemes. No official report of the conference would be issued, but the education committee would study the points made in the discussion.

INDUSTRIAL NEWS

Power Convention Exhibition

Since last month's announcement that there is to be an electrical exhibition in connection with the British Electrical Power Convention at Torquay from 1st to 5th June, 1959, it has been decided that the exhibition will be housed in the canvas framed buildings used so successfully in recent years. It is hoped that a site adjoining the Conference Hall in the Pavilion will be made available.

Some thirty-five exhibitors have already requested space and manufacturers in all the usual fields are represented. Consideration is being given to a water heating and cooking feature, illustrating the national domestic advertising campaign. Its purpose would be to show the ways in which E.D.A. display material can help sell water heating and cooking.

Japanese Nuclear Agreement

The General Electric Co., Ltd., has drawn up an agreement with a group of companies in Japan formed by the Fuji Electric Co. to provide for licensing arrangements for the construction of nuclear power stations in Japan and the rest of the Far East. The agreement is subject to approval by the Japanese Government. The Fuji Electric Co. is to pay a licence fee of between £140,000 and £180,000 and royalties of 4 per cent to the G.E.C. and about 3 per cent to the U.K. Atomic Energy Authority.

A spokesman of the General Electric Co. said in London last week that the present agreement was not an indication that the contract for the first Japanese nuclear power station would be awarded to his firm. The effect of the agreement is to appoint the group of firms headed by the Fuji Electric Co. as local agents and sub-contractors for any nuclear power stations for which the G.E.C. may be awarded the main order in Japan or the Far East, where, he added, a "good market exists."

Three British consortia led by the A.E.I., G.E.C. and the English Electric Co. are seeking a contract from the Japanese Atomic Power Generating Co. for a Calder Hall type nuclear power station. A "letter of intent" is expected to be placed before the end of the year.

New Commonwealth Preference Regulations

The Board of Trade has published the Commonwealth Preference Regulations, 1958, which lay down the conditions for eligibility for Commonwealth preference on goods which have been manufactured in the Commonwealth Preference Area. The new Regulations will come into operation on 1st January, simultaneously with the new Brussels Nomenclature tariff, and will replace the current Regulations. They reproduce the effect of the old Regulations and lay down the condition that, in order to qualify for Commonwealth preference, manufactured goods must have been manufactured in the Commonwealth Preference Area and a minimum proportion of the cost of manufacture must be attributable to work done or materials grown or produced in the Area. Cost of manufacture is defined, broadly, as cost of materials, wages, and overheads. The Regulations apply to both protective and revenue duties.

Improved Fluorescent Lamp Efficiencies

New techniques in phosphor processing, recently adopted in the manufacture of "Osram" fluorescent tubes by the General Electric Co., Ltd., have enabled higher efficiencies to be achieved for its cold cathode tubes (9ft 6in overall length, 20 mm diameter). Light output has been increased by up to 10 per cent, and in the warm white colour, for example, the average efficiency throughout life has been raised from 37 to 41 lm/W. At the normal tube current of 120 mA the power dissipation is approximately 67·5 W, to give a total light output of 2,770 lm for this colour. Similar increases are now effective for all other colours in the range.

British Council's Annual Report

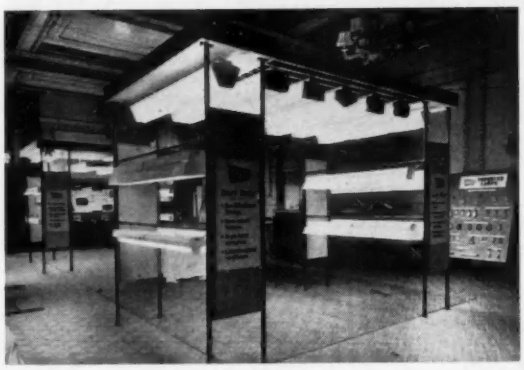
The annual report of the British Council for 1957-58 shows that since the war the Council has arranged programmes for more than 50,000 professional visitors from overseas studying British developments and achievements. The yearly number has more than doubled to nearly 5,000 in 1957-58. Only a fifth were financed by the Council. About another fifth, 1,012 (mainly United Nations fellows and Colombo Plan trainees), were financed under inter-governmental schemes, compared with 191 in 1950. About £380,000 a year is administered by the Council for international and overseas organisations. In 1957-58 visitors concerned with science totalled 42·6 per cent as compared with 23·5 per cent in 1950-51. The number of overseas students in the United Kingdom rose in 1957 to 35,000, and is now about 38,000. Less than a third are at universities, the rest being trained elsewhere, many at technical and other colleges. An article by Sir Charles Snow, a member of the Council's Executive Committee, points out that about 1½ million books are borrowed yearly from the Council's libraries for professional students overseas, and most of the Council's expenditure on the printed word goes on supplies of books and periodicals. He stresses the need for far more British books overseas. The Council expanded in various countries, including Nigeria, Iran, India, Pakistan and Poland, and next year will take over British educational and cultural work in Germany. The gross expenditure rose to £3,867,899 in 1957-58, of which £3,378,271 was voted by Parliament and £489,628 came from earnings.

New Racal Engineering Division

Racal Engineering, Ltd., has formed a separate division to deal with all matters relating to its range of instruments. The new instrument division has its own development laboratories under the chief engineer, Mr. N. Elson, and also includes a special products section which will design, manufacture and install digital or non-digital instrumentation schemes for special applications. A strengthened sales force and a separate Instrument Service Department has also been created to enable comprehensive sales and servicing facilities to be available quickly throughout the whole of the United Kingdom. An applications engineer is available to advise on the application of digital techniques to general industrial problems. The sales manager of the new instrument division is Mr. I. H. M. Campbell.

Ekco Lighting Exhibition

Ekco-Ensign, Ltd., has prepared a display of its new "Essex" and "Economy" ranges of fluorescent fittings which is being shown in over



The Ekco Lighting Exhibition which is touring various parts of the country

twenty of the main towns in England, Scotland and Wales in selected hotels and centres. Invitations are being sent to wide sections of the electrical trade, contractors, architects and industrial and commercial concerns interested in modern lighting.

Devon Catering Exhibition

About 1,000 hoteliers from all over Devon and Cornwall, and from as far afield as Surrey and Dorset, visited the Electrical Catering Equipment Exhibition recently held at the Victoria Hotel, Torquay. The display was organised by the South Western Electricity Board with the co-operation of twenty leading equipment manufacturers. Equipment shown was selected chiefly for its suitability for the medium-sized hotel to the smallest establishments and included electric cookers, ovens, washing-up machines, frying and grilling equipment and slicing and mixing appliances. The Mayor and Mayoress of Torquay (Alderman and Mrs. E. G. Milford) visited the exhibition on the opening day at the invitation of Mr. G. T. Garwood, the Electricity Board's Devon Group Adviser. The exhibition has proved so successful that it is proposed to hold one every two years.

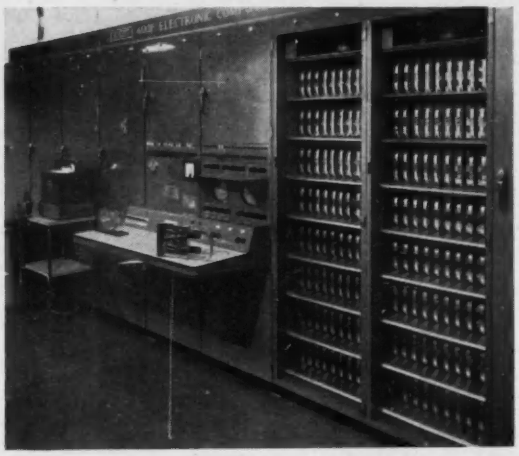
Air Transport Electronics Council

The inaugural meeting of the Air Transport Electronics Council was held on 18th November, when Sir Victor Tait, K.B.E., C.B., B.Sc., was appointed chairman. The Council has been formed from members of the Electronic Engineering Association (representing British radio and electronics manufacturers), the Society of British Aircraft Constructors, British Overseas Airways Corporation, British European Airways and British Independent Air Transport Association. Its aim is the standardisation of civil aircraft radio equipment and systems installations and to promote development of systems for future air operating requirements. The secretariat for the Council is being provided by International Aeradio, Ltd., and Mr. J. S. Simpson has been appointed as secretary to the Council. The secretary recently visited the United States for discussions with Aeronautical Radio Inc. and has established a liaison with a view to mutual co-operation between the two organisations. The Council offices are at 37, Park Street, London, W.1 (telephone: Hyde Park 5024).

Computer for British Railways

An electronic computer has been installed by British Railways in the physics division of their research department at Derby. This machine, an Elliott 402F computer, is a general purpose computer with a medium size memory which enables it to store and perform operations on over 4,000 numbers simultaneously, the input and output of data being by paper tape. An additional feature has been provided in that floating point arithmetic can be used; this permits greater accuracy in a far bigger range of numbers. The speed of the computer is such that pairs of numbers, each of nine digits, can be multiplied at the rate of 300 in one second.

It is intended that numerical calculations will be made on vibration problems, including, for instance, those concerned with the improvement of passenger coach comfort, the analysis of stresses in structures and bridges, and problems relating to the development of continuous braking for freight trains, to assist engineers in design and testing. A further field is that of linear programming, which is of interest in statistical inquiries, such as those involving the determination of optimum conditions where many variable factors are concerned, e.g. the most economic way of carrying out a complex set of wagon movements.



Elliott 402F electronic computer installed by British Railways in the Research Department, Derby

F.B.I. Register

In a foreword to the "F.B.I. Register of British Manufacturers—1959," Sir Hugh Beaver, president of the Federation of British Industries, says that with the conscious struggle to raise general living standards in every country the demand for all kinds of consumer and capital goods, in spite of temporary slackening, is tending to rise from decade to decade. To meet this growing demand British firms can offer practically every type of product which commands a market, and it is to help prospective buyers that this publication is primarily intended.

The Register contains lists of products and services of over 7,500 member firms under more than 5,400 alphabetical headings. In addition to the classified buyers' guide there are seven other sections in the Register, giving addresses of companies and firms, and information on trade associations, proprietary names, trade marks, etc. French, German and Spanish glossaries give translations of every product term used in the main buyers' guide. The Register is published for the Federation of British Industries by Kelly's Directories, Ltd., and Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1, price 42s post free.

Lifeboat Lighting

Approval has been given by the Royal National Lifeboat Institution for "Eascolyte" low voltage fluorescent lighting equipment to be used in all future lifeboats built for their service for providing the main engine room and cabin illumination. The equipment, developed jointly by Easco Electric (Holdings), Ltd., and the Plessey Co., Ltd., consists of a number of small fluorescent fittings each housing a standard 12in 8 W tube, which are operated by their own individual control units. The control units incorporate vibratory convertors and the other components necessary to convert the d.c. input of either 12 or 24 V obtained from the craft's batteries to a.c. of a suitable level to strike and run the tubes.

The number of units fitted varies from two to six according to the size of the lifeboat and by the adoption of the principle of a separate control unit for each fitting the failure of one light will not affect the remainder. The control units fitted to lifeboats and ambulances have special suppression for radio-telephone equipment working in the 1 to 3 Mc/s band.

G.E.C. Sales and Production Changes

Important policy changes concerning valves and associated products and semi-conductors are announced by the General Electric Co., Ltd. They are intended to simplify existing sales and production arrangements by bringing the customer into direct contact with the producing factories.

As from 1st December, the responsibility for the sale of all valves and cathode-ray tubes for the entertainment market, as well as for the photocells, barretters, neon indicators, etc., which have hitherto been handled by the Valve and Electronics Department of the company, will be taken over by the M.O. Valve Co., Ltd. By adding these products to its existing activities in the industrial valve and tube field, the M.O. Valve Co. will in future deal with all wholesale and special order aspects of the G.E.C. valve and cathode-ray tube business. Domestic radio and television valves and tubes,

however, will continue to be sold direct to retailers by the Radio Division of the G.E.C.

From 1st December the semi-conductor business will be operated, as regards both manufacture and sales, from the semi-conductor factory at Hazel Grove, Stockport, Ches., where all inquiries and orders for semi-conductor products will be dealt with. Sales were formerly handled by the Valve and Electronics Department in London.

These arrangements involve a number of executive changes which we report in our "Personal and Social" section.

Transformers for Kariba

The second 330 kV transformer unit built by Ferranti, Ltd., for the Kariba hydro-electric scheme, Southern Rhodesia, was recently dispatched. It will be installed at Norton transformer station. These units form part of a £1,241,000 contract awarded to Ferranti's by the Federal Power Board of Rhodesia and Nyasaland. It is the largest overseas transformer contract yet placed in the United Kingdom and is the first covering the supply of 330 kV three-phase units to be placed with a British manufacturer. The transformers are of the oil immersed ON/OFB type fitted with FC4 high speed resistor transition on-load tap changing equipment and with windings arranged for directed oil flow.

E.M.E.B. Nottingham Showrooms

New showrooms and offices for the East Midlands Electricity Board were opened by the Lord Mayor of Nottingham, Ald. J. Littlefair, on 19th November. Originally a departmental store, the building has been reconstructed internally, and the new premises will replace the Board's showroom in Smithy Row, Nottingham, and accommodate staffs of other offices dispersed over the city.

At the opening ceremony, which took place in the demonstration theatre, Mr. J. Mould, chairman of the Board, welcomed the Lord Mayor and Lady Mayoress, Councillor F. W. Wootton, the Sheriff, and Mrs. Wootton, and said that they had recently extended the Nottingham Sub-Area to many outlying districts, and it was felt the Smithy Row showrooms were becoming inadequate to serve the growing need of consumers. The new showrooms, they hoped, would give greater efficiency in that direction. Mr. N. F. Marsh, deputy chairman, on behalf of the Board, presented the Lady Mayoress with a refrigerator.

The ground floor of the new premises is given to display and the restyled frontage provides the look-through window setting. Showroom decor is mainly contemporary. Distinctive lighting, designed by the G.E.C. in conjunction with the architects, Evans, Cartwright & Woollatt, has entailed the use of more than a quarter of a mile of fluorescent tubing. The demonstration theatre seats 250. The stage is constructed as a modern kitchen, on the unit principle. The rest of the building's four floors house display rooms, offices and a canteen.

Ship's Generating Plant

W. H. Allen, Sons & Co., Ltd., Bedford, have received an order from Vickers-Armstrongs, Ltd., to supply the entire generating plant for the new 40,000-ton Orient liner *Oriana*, comprising four 1,750 kW pass-out condensing turbo-generator sets and two 200 kW diesel engine-driven emergency generators. They will also supply most of the electrical equipment for the engine-room auxiliaries, consisting of stabilising gear, main and auxiliary circulators, ventilating fans, refrigerating gear, etc., and the electrical equipment for the manœuvring controls.

Another contract received from Vickers-Armstrongs, Ltd., is for the entire generating plant, comprising two 1,500 kW condensing turbo-generators and three 500 kW diesel engine-driven generator sets, with the electrical equipment for the stabilising gear and other engine-room auxiliaries, for the new 27,500-ton liner being built for Canadian Pacific Steamships, Ltd.

Mr. J. Mould, chairman, East Midlands Electricity Board, speaking at the opening of the Board's new showrooms and offices in Carrington Street, Nottingham. Others (left to righ) are Mrs. Marsh, the Sheriff of Nottingham (Coun. F. Wootton), Mrs. Mould, the Lord Mayort of Nottingham (Ald. J. Littlefair), the Lady Mayoress, Mr. N. F. Marsh (deputy chairman) and Mrs. Wootton

Blackburn Aircraft to Manufacture Electronic Equipment

Blackburn & General Aircraft, Ltd., has decided to design and manufacture electronic equipment commercially. A new organisation, with its own design and development departments and production and sales organisations, has been formed at Brough under Dr. H. Fuchs. The new organisation will concentrate on electronic equipment for industrial applications, such as data handling, control and instrumentation.

Quality Control Service

The use of the techniques of quality control has grown rapidly in recent years and is likely to become much more important in the future. The European Free Trade Area proposals and the European Common Market have brought to the fore the desirability of an international appreciation of standards of quality and the use of quality control procedures. The European Productivity Agency has therefore set up a European Organisation for Quality Control, with headquarters in Rotterdam. The British Productivity Council has been appointed to represent the United Kingdom on the management of the E.O.Q.C. and full details can be obtained from the Council (21, Tothill Street, London, S.W.1), which is instituting a subscriber service.

Y.E.B. and Clean Air Campaign

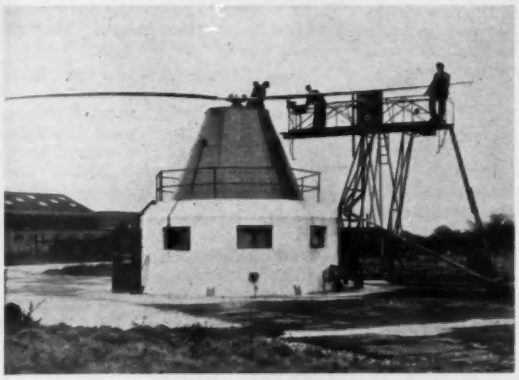
The Yorkshire Electricity Board is co-operating in the Clean Air Campaign by providing stands at exhibitions which are being held in various parts of the West Riding through the winter months. A recent display at Shipley was notable for the interest shown by youthful members of the community.

Ideal Home Exhibition

The *Daily Mail* 1959 Ideal Home Exhibition will be held at Olympia from 3rd to 30th March. The Exhibition will include the British Government Pavilion from the Brussels Fair.

Helicopter Testing

A new rotor blade test tower has been designed and built by Bristol Aircraft, Ltd., to speed the testing of production rotor blades. The tower, which is an octagonal steel and concrete truncated cone, 18ft in height and with a diameter of 6ft 6in at the top and 20ft at the base, represents the "hovering" condition. The drive to the rotor is from the main Crompton Parkinson 400 h.p. d.c. motor via a gearbox and vertical drive shaft with



Helicopter blade test bed powered by Crompton Parkinson motor

a standard rotor hub at its upper end. A mixed Ward-Leonard and shunt control system is used to govern the speed of the motor over a range of 80 to 1,264 r.p.m. The Ward-Leonard control is used for the low speed requirement, 80/800 r.p.m. From 800 to 1,264 r.p.m. the full 400 h.p. of the motor is available under shunt control. The constant speed motor-generator set, comprising an auto-synchronous motor and exciter and a generator and its exciter, runs at 1,000 r.p.m.

Properties and Uses of Magnesium

An illustrated booklet dealing with the properties and uses of magnesium and its alloys has been issued by the Magnesium Industry Council. The various forms in which magnesium is available are reviewed, including sand and die castings, forgings, sheet, strip, tube and extrusions. A summary of their inherent characteristics is given and typical applications of each form illustrated. Copies of the booklet are available from the secretary of the Council at Dickens House, 15, Took's Court, Chancery Lane, London, E.C.4.

Battery Charging Equipment

The first part of a large order covering the supply of vehicle battery charging equipment in the new assembly building for the Ford Motor Co. at Dagenham, has been secured by the rectifier division of the Westinghouse Brake & Signal Co., Ltd.

The company has also received an order from Cork Corporation for the supply of vehicle battery charging equipment through the Murphy Electric Co.

Illuminated Sign Design Competition

Details of the third illuminated sign design competition, sponsored by the Electrical Sign Manufacturers' Association, have been announced. Ten cash prizes, ranging from £150 for the first prize to five £10 consolation prizes, will be given for the best designs for illuminated sign displays on an actual building which forms part of the main shopping street of a new town. The building chosen for the competition comprises a single shop used as a florists, and a double shop used as a small departmental store. The upper part of the building is occupied by the store as showrooms and as a restaurant. In both the previous competitions sponsored by the Association imaginary buildings specially drawn by architects were used. This time an existing building has been chosen to give a more practical approach to the competition. The last date for the receipt of entries is 31st January next and details of the competition and copies of the rules can be obtained from the Electrical Sign Manufacturers' Association, 13, Bedford Row, London, W.C.1.

Automation and Computation

We have received a copy of the first issue of *B.C.A.C.*, the Bulletin of the British Conference on Automation and Computation. One of the main objects of the Conference is to facilitate the exchange of information on the activities within the field of automation and computation of the many individual societies which make up its membership. The Bulletin will be issued bi-monthly. Requests for individual copies (1s post free to members and 2s to others) or subscriptions (6s and 12s per annum respectively for members and non-members) should be sent to the B.C.A.C. Bulletin, c/o the Institution of Mechanical Engineers, 1, Birdcage Walk, Westminster, London, S.W.1.

Aluminium Overhead Lines

A new publication entitled "Aluminium for Overhead Distribution Lines" has just been produced by the Aluminium Union, Ltd., Adelphi, John Adam Street, W.C.2. This book gives an introductory description of suitable methods for selection and installation of aluminium conductors for rural and urban overhead distribution lines. It is concerned particularly with two classes of overhead electrical transmission, viz. rural distribution and urban feeders up to 33 kV and urban overhead and rural secondaries from 110 to 660 V. Suitable methods for installing aluminium conductors and accessories are briefly described.

British Electrical Industry at Rand Easter Show

The British Electrical and Allied Manufacturers' Association is to be represented in the new United Kingdom Pavilion at the 1959 Rand Easter Show to be held in Johannesburg from 17th to 27th March next. Under the title "Power for Progress" the B.E.A.M.A. Southern African Overseas Committee will stage a collective exhibit portraying Britain's great contribution in the electrical field. Many of the prize-winning exhibits from the Brussels International Fair will be shown, and the exhibit will have three sections: "Power from the Earth," "Power from the Hills" and "Power from the Atom."

Radiation Window Display

The Yorkshire Electricity Board has installed a window display at its Headrow (Leeds) Service Centre which marks the unity of Parnall (Yate), Ltd., and the Jackson Electric Stove Co., Ltd., as the Electrical Division of Radiation, Ltd. The display shows the home laundry equipment and cookers of the respective companies. The drum of the tumbler dryer revolves and the wedding bell swings disclosing the names of Parnall and Jackson.

The Parnall-Jackson display (Electrical Division of Radiation, Ltd.) at the Leeds Service Centre of the Yorkshire Electricity Board

Furnaces for Russia

Electric furnaces for Machinoimport, a Russian trading organisation in Moscow, were dispatched recently from the works of Birlec, Ltd. The equipment included a 24in mesh belt conveyor furnace for heat treating steel components, a horizontal batch furnace for toolroom heat treatment and a generator for maintaining a protective atmosphere within the mesh belt furnace.

Board Engineer's Death

It was suggested at an inquest at Mansfield last week that a wet cobweb or straw may have caused a short-circuit, resulting in the death of

Mr. Herbert Tarlton, employed by the East Midlands Electricity Board. Mr. Tarlton was killed while switching off an 11 kV supply at Skegby, near Mansfield, to remedy a line fault. It was stated by Mr. K. M. Briggs, district engineer, that the earthing connections of the switch were satisfactory. A verdict of "Accidental death" was returned.

Price Reduction

The intermediate power transistor, which was introduced by Newmarket Transistors, Ltd., in April last, has now been reduced in price by more than one-third.

Trade Announcements

The London district office of the **British Thomson-Houston Co., Ltd.,** is now at 33, Grosvenor Place, London, S.W.1 (telephone: Belgravia 7011).

Great Lakes Carbon International, Ltd., with sales offices at 140, Park Lane, London, W.1, has been appointed sales representative for all commercial products of the new Anglo Great Lakes Corporation, Ltd., graphite plant at Newcastle-upon-Tyne. In addition, the firm will also market graphite products of the Great Lakes Carbon Corporation, U.S.A., throughout the United Kingdom and Western Europe.

The sale of "Noral" castings, forgings, and electrical conductor accessories is now handled by the Castings and Forgings Sales Division of the **Northern Aluminium Co., Ltd.,** under the managership of Mr. A. Gregory. This is situated at the works at Middlemore Road, Handsworth, Birmingham. The telephone number is Birmingham, Northern 3671; telegraphic address "Noraluco, Birmingham."

E. K. Cole, Ltd., has appointed Mr. S. A. Baker as "Ekco" heating sales representative for the East Midlands area. He succeeds Mr. E. J. Bolan, who is now responsible for technical sales in the entire Midlands area.

Subsidiary companies of the former **Siemens Brothers & Co., Ltd.,** in Australia, Canada, Central Africa and South Africa have changed their names by substituting "Siemens Edison Swan" for "Siemens."

James Gordon & Co., Ltd., have recently added a third building to their premises at Dalston Gardens, Stanmore. This provides accommodation for the enlarged Projects Department, new stores for spares and service requirements and a canteen for the staff.

The telephone number of the Nottingham branch office of **British Insulated Callender's Cables, Ltd.,** has been changed to Nottingham 55932.

As from Monday next the address of the **Armorduct Cable Co., Ltd.,** will be 1-3, Brixton Road, London, S.W.9 (telephone: Reliance 7044). The stores will remain at 3, Upper Marsh, London, S.E.1.

Change of Address

The address of the Crawley and Horsham District office of the South Eastern Electricity Board is now 50-52, The Broadway, Crawley, Sussex (telephone: Crawley 25921).

PARLIAMENTARY REPORT

Free Trade Area Setback

Mr. R. Maudling, Paymaster General, who is the Cabinet Minister in charge of the Government's negotiations for the establishment of a European Free Trade Area, informed the House that since the French Government had announced that they could not support the Free Trade Area as it had been proposed, negotiations had been suspended. He said that the British Government had always recognised the special difficulties of France and any proposals put forward by her and the other five to safeguard the economic position of France would be readily considered. The Government did not believe that the solution of this problem would involve the abandonment of the idea of a Free Trade Area. But if the Common Market came into operation without a Free Trade Area in existence the consequences would be serious. The Government would enter straight away into consultation with the other Governments to clarify the situation.

Developing Inventions

In a debate on the Development of Inventions Bill, Mr. J. Rodgers, Parliamentary Secretary, Board of Trade, explained that it continued financial support for the National Research Development Corporation for a further ten years. He said the Corporation was expected to help other research organisations and ensure that new ideas with valuable industrial applications did not lie undetected in publicly-financed research laboratories. Another of its functions was to develop any private inventions which seemed to be worthwhile, but were neglected. The Corporation was also asked to undertake research to solve specific problems. Whenever an invention was ready for commercial application the Corporation's task was merely to patent it and licence it to industrial users. Currently it held nearly 1,000 British patents and nearly 2,000 overseas patents. Its licensing agreements were bringing in royalties of about £170,000 a year, one-third in dollars from the United States. Among its development projects were inventions for food preservation and a flat cathode-ray tube for colour television. It had also made a substantial contribution to the growth of an electronic computer industry in Britain.

Scientific Research

Replying to a question by Mr. F. Willey, Mr. Harmar Nicholls, Parliamentary Secretary, Ministry of Works, said that this year the Government-aided Research Councils would be spending about £20 million as compared with less than £9 million eight years ago.

Post Office Capital Investment

Mr. Ness Edwards asked the Postmaster General what revision could be expected of the present limited capital investment programmes of the Post Office following the general relaxation of the public investment programme.

Mr. Marples replied that the Post Office investment ceilings were set a year ago at £95 million for 1958-59 and £90 million in 1959-60. That for 1958-59 had already been raised to £96½ million. The question of possible additions was not yet settled.

Use of Small Coal

Mr. Palmer asked the Paymaster General if, in order to utilise to the maximum the abundant supplies of small coal now available, he would issue general directions in the national interest to the Central Electricity Generating Board to abandon entirely the use of oil in power stations; to the Gas Council to concentrate all possible resources on developing processes for the hydrogenisation of small coal; and to the National Coal Board to discuss terms for the sale of coal to power stations such as would enable the Electricity Boards to offer in bulk off-peak supplies of energy for space heating at low and competitive prices.

Mr. Reginald Maudling: "No, sir. I am satisfied that the industries concerned are already doing everything practicable to develop the uses of small coal." Questioned further, he said that the electricity industry was doing as much as it could to reduce the use of oil, short of breaking contracts. The Gas Council was doing a lot of work on the hydrogenisation of small coal. As for the third suggestion, that seemed to be largely a commercial matter on which the Coal Board should take the initiative.

Ferroelectrics

PROPERTIES AND APPLICATIONS

AT a meeting of the Measurement and Control Section of the Institution of Electrical Engineers on 18th November, Mr. L. A. Thomas opened a discussion on ferroelectrics which, he said, had come to the fore during the past five years owing to the advent of new and improved materials and of devices for taking full advantage of their special properties. Ferroelectricity, like ferromagnetism, exhibited hysteresis associated with spontaneous polarisation, but differed fundamentally in that this was mainly due to atomic or ionic displacements instead of alignment of electron spins. Generally, too, ferroelectric domains were larger and under certain conditions were visible in single crystals. Ferroelectric substances exhibited *reversible* spontaneous electrical polarisation. The discovery of the effect in barium titanate during the last war enabled ferroelectrics in ceramic form to be used in miniature "high-κ" capacitors on account of the high permittivity obtainable.

Sintered ferroelectric materials could be prepolarised by the application of a unidirectional field and on its removal exhibit a permanent linear piezo-electric effect. Their applications included ultrasonic generators, vibration measuring instruments, resonators for selective networks and gramophone pick-ups. Existing barium titanate materials had a restricted range of operating temperatures and a high temperature variation of their piezo-electric and electric constants, but fruitful discoveries had been made in connection with the high-temperature materials lead zirconate-titanate and certain niobates. A high Curie temperature in a new ceramic was insufficient, because the onset of poor resistivity often lowered the temperature substantially below that at which ferroelectricity (and hence piezo-electricity) disappeared. However, 250 deg C or more was now obtainable, against about 100 deg C for barium titanate materials, and this increase more easily minimised the temperature variation of important physical parameters.

Computer Storage Devices

Single crystals of ferroelectrics normally revealed rectangular hysteresis loops having two stable states of remanent polarisation and thus, in principle, could make suitable computer memory devices capable of storing several hundreds of bits of information. The chief practical problems were to grow crystals of adequate quality and size at lower cost and to minimise the effect of an indefinite coercive field. In the latter case repeated pulses, each insufficient to switch a memory cell, might eventually switch unselected cells. Ferroelectric storage devices, being voltage operated, would require less current than ferrite toroids. Experimental switching times of 1 microsec for barium titanate and triglycine sulphate would probably not be feasible in a practical computer, partly because of internal heating. At present it seemed unlikely that ferroelectrics would be widely used for storage, though they might find important small-scale uses in this field.

Continuing the discussion, Dr. L. E. Cross referred to the effect of surface layers in ferroelectric materials, the first evidence of which came by chance from work on small particles of barium titanate having dimensions comparable to the domain size. It had been suggested that the surface of the crystal would probably be a store or sink of defects and therefore there would be a changing defect concentration between the surface and the bulk of the material, which would give rise to a built-in field from the consequent space charge layer resulting in saturation effects. The field was sufficient to raise the Curie temperature of the surface.

A lamp source of infra-red radiation was caused to shine on the surface of the crystal with a shuttering device in between. When the light was switched on, the temperature of the crystal and the spontaneous polarisation were changed, causing a current in the external circuit; this gave some non-destructive measure of the polarisation and showed that above the Curie temperature one still got a ferroelectric signal which suggested that there was a material above Curie point which was spontaneously polarised.

With annealing surfaces the piezo-electric effects could be reduced. The capacity did not apparently change with the characteristics of the surface layer, possibly indicating that the surface layer had a low impedance compared with the bulk of the specimen. Crystals down to 10^{-5} cm thick in the form of a thin layer still showed ferroelectric effects, in comparison with which the surface layer thickness must therefore be small.

Further Experiments

A rather different type of surface layer had been suggested by other experiments on the switching properties of barium titanate crystals. This work showed that the surface layer must have an impedance value comparable to the impedance of the thin specimen, its dielectric constant being not very different from that of the bulk. Fresh ideas had come from work done on electric breakdown initiated by discharges which led to a rapid rise in the apparent strength of the material with decreasing thickness.

Mr. J. M. Herbert referred to the application of ferroelectrics to capacitors. Almost any improvements increased the cost of the material. Ferroelectrics used in circuits aged, resulting in a gentle drifting of capacity, imposing a limit on what was worth while in stabilising a titanate capacitor with respect to temperature. There was no point in making a ferroelectric with an accuracy of 0·1 per cent over 100 deg C if it drifted 5 per cent in a year's use. Lead titanate zirconate was reported to be very much better than barium titanate in this respect. Piezo-electric properties also varied with time.

The Russians had published some work on strontium bismuth titanate giving permittivity of about 1,000 with high resistivities at high temperatures and with a moderate negative temperature coefficient. They claimed that this was non-ferroelectric because it did not have a very distinct permittivity temperature; at least, the permittivity temperature was frequency dependent. That seemed to be an admirable dielectric if only the permittivity factor could be pushed up. There might then be a future in the high permittivity field outside dielectrics.

Mr. C. F. Oxbrow referred to alternative materials for ferroelectric storage. He explained the relationship of the coercive field against frequency in all three possible materials—G.A.S.H., barium titanate and glycine sul-

phate. Glycine sulphate had a much lower coercive field—2:1—than barium titanate, which made it attractive. Unlike barium titanate, the crystals were rather pliable, so that one worked with rather thicker crystals. Early experiments with barium titanate seemed to indicate loss of "memory" under certain conditions, but there was no apparent comparable effect with glycine sulphate.

A substantial advance in "high-κ" capacitors had been made when the Russians had stressed the importance of bismuth oxide in "high-κ" ceramics. A French firm now made such capacitors which would withstand 150 deg C for thousands of hours, the characteristic of permittivity against frequency being fairly flat.

Using bismuth-oxide flux, he had recently increased the operating temperature of such capacitors to 200 deg C on a laboratory production scale, but there was not likely to be much difficulty in producing capacitors to withstand that temperature indefinitely. The main trouble would be in getting material proof against humidity. The bismuth oxide appeared to act as a sort of clamp and to prevent the formation of the tetragonal phase at room temperature.

Mr. D. S. Campbell referred to switching problems of barium titanate and to work on the decay effect achieved here and in the U.S.A. Polarisation appeared to get smaller on continued switching, but not if the switching were done slowly, presumably because the decay effect had time to recover. If the switching were done very quickly, the crystal heated itself, and to some extent that, too, appeared to prevent the decay effect. Decay occurred over only a limited range with a peak of about 600 cycles and also seemed to be closely associated with the rest time of the poles being used, since it did not happen with solenoids. That was one of the ways of causing a decayed crystal to recover.

Mr. Burfoot said that at Queen Mary College some crystals with somewhat low polarisation recovered with time constants of some hours when used with sinusoidal waveforms. The recovery growth was not frequency dependent, but was dependent on amplitude.

Mr. West endorsed Mr. Herbert's views on the necessity for cheapness in capacitor materials and wished they could also be plastic. High density was important. An X-ray analysis of ground powders would determine the theoretical density, but to produce a practical ceramic of comparable density without such measures as firing in oxygen was often difficult.

Mr. C. G. Garton said that large currents could be passed electronically through single oxygen-deficient titanium crystals. It was not known how far that process took place in barium titanate. It certainly occurred in other oxides, tungsten oxide, for example.

Mr. Davies said that switching experiments had shown them an inexplicable drifting outwards of the corners of the hysteresis loop. It was thought that this might be due to moisture.

GARRY HYDRO-ELECTRIC SCHEME

IN a paper presented for discussion at the Institution of Civil Engineers recently, Messrs. C. M. Roberts, E. B. Wilson and J. W. Thornton of Sir William Halcrow & Partners and Mr. H. Headland of Messrs. Kennedy & Donkin described the Garry and Moriston schemes of the North of Scotland Hydro-Electric Board. The two schemes are operated as one group with a control centre at Fort Augustus. Main particulars of the Moriston undertaking were given in the *Electrical Review* of 3rd October.

The Garry catchment area of 147 sq miles lies to the south of Moriston and includes two main power stations, Quoich and Invergarry, and two auxiliary compensation-water stations. Quoich contains one 22 MW, 300 r.p.m. horizontal Francis turbine (design head, 255ft), which is expected to provide a mean annual output of 74·4 million kWh. Invergarry is of semi-underground construction and contains one 20 MW, 250 r.p.m. high head vertical Kaplan turbine (146ft head) with an annual output of 81 million kWh at 47 per cent load factor. In the auxiliary station at Quoich is installed a 350 kW, 762 r.p.m. horizontal Francis turbine (head 113ft) and in the one at Invergarry there are 255 kW, 230 r.p.m. and 30 kW, 762 r.p.m. vertical Francis turbines. The former station has an annual output of 2·6 million kWh and the latter 1·4 million.

The main stations with synchronous generators are partly attended and are started and stopped by local push-buttons with provision for remote control from Fort Augustus. The auxiliary stations with induction generators are unattended except for occasional visits for output adjustment and maintenance.

Station lighting is by fluorescent lamps fitted below the crane runway. Emergency lighting is provided by 110 V batteries. Overlapping differential systems protect the 11 kV alternators, 11 kV breakers and main transformers. In addition, alternators have over-voltage, negative-phase-sequence and over-current protection and transformers have Buchholz relays. On the h.v. side of the transformers are 132 kV motor-operated isolators with interlocked line-maintenance earthing contacts and single-phase fault-throwing switches for automatically tripping the associated 132 kV circuit-breaker at Fort Augustus. Essential machine auxiliaries are fed from a 11 kV/433 V unit transformer connected to each alternator, stand-by being provided by manual change-over to the station common service board, which is fed from either a 200 kVA transformer on the 33 kV system or a 200 kVA earthing transformer. Auxiliaries needed at starting or shut-down or on a.c. supply failure are catered for by the station battery.

Details are given in the paper of the rockfill dam built at Quoich, with appreciable saving of cement, and of the advantages of the wet-grinding process for Trief cement, which requires less power and may prove to be more resistant to attack by acid water than Portland cement. Underground construction in the Highlands has been found to cost no more than surface stations. The extensive measures taken for the preservation of salmon in the River Garry are described in detail.

Consulting engineers are Sir William Halcrow & Partners (civil) and Messrs. Kennedy & Donkin (mechanical and electrical) and the architects for the Garry scheme are Messrs. Gratton & McLean.

Principal mechanical and electrical contractors for Garry works are: Quoich main station, Boving & Co. (turbine) and English Electric Co. (alternator); Quoich auxiliary station, Gilbert Gilkes & Gordon (turbine) and Bruce Peebles & Co. (alternator); Invergarry main station, English Electric Co.; Invergarry auxiliary station, Armfield Hydraulic Engineering Co. (turbine) and Bruce Peebles & Co. (alternator).

Tests on Narrow Insulating Tapes

EQUIPMENT AND PROCEDURE FOR MEASURING ELECTRICAL BREAKDOWN

By
J. DRYSDALE*

After describing the electrode system for short-time dielectric strength tests on proofed tape insulating materials, the author outlines the modifications to the equipment for tests on other tapes such as silicone rubber proofed woven glass material

DIELECTRIC strength tests on insulating materials afford a measure of the maximum potential gradient that the materials will support when stressed electrically between two specified electrodes under prescribed conditions. The results are calculated from the voltage at which breakdown occurs when raised at a predetermined rate and the thickness of the material, and are usually expressed in volts/mil or volts/cm. It is usual to make the tests with alternating voltages and at mains frequency.

Short-time dielectric strength or breakdown tests are of considerable value to the cable manufacturer in comparing different materials, in controlling manufacture, and in the measurement of deterioration or contamination in cables after periods of use or laboratory accelerated ageing. Other forms of dielectric strength or breakdown tests such as step-by-step tests or long-time voltage tests are of value in assessing the ability of materials to withstand electrical stresses over prolonged periods of time.

Electrode System

For short-time dielectric strength tests on proofed tape insulating materials the apparatus normally used is that described in B.S. 419 "Varnished Cotton Cloth Sheet and Tape for Electrical Purposes." This apparatus, based on the recommendations of the American Society for Testing Materials (A.S.T.M. designation D.149 34-T), is stated to be suitable for tapes not less than $\frac{3}{4}$in wide. As illustrated in Fig. 1 the electrodes consist of opposing cylindrical brass rods $\frac{1}{4}$in in diameter with edges rounded to a radius of $\frac{1}{32}$in, and provision is made for the clamping of insulating material on each side of the edges of the tape undergoing test to minimise flashover.

Some of the less widely used and more expensive heat-resisting insulating materials, such as silicone rubber coated glass cloth, are purchased in the widths of tape required for manufacturing cables and not in roll form for subsequent cutting at the works. For manufacturing control purposes it is desirable to conduct a dielectric strength test on the tapes, which in some cases, for the smaller cables, are less than $\frac{3}{4}$in and can be as narrow as $\frac{1}{4}$in in width. The majority of insulating tapes of this type are from 5 to 10 mils in thickness and these require voltages ranging from 5 to 15 kV r.m.s. to effect a puncture. As the surface breakdown strength of most of these materials is in the range of 24 to 26 kV r.m.s. per inch, difficulty is experienced in preventing flashover with tapes less than $\frac{3}{4}$in wide using $\frac{1}{4}$in electrodes.

Since the B.S. 419 apparatus in its present form was obviously not suitable for the narrower tapes, work was initiated in the Research Laboratories of W. T. Henley's Telegraph Works Co., Ltd., to investigate various methods in an endeavour to find one which would be applicable to all widths of tapes, without producing unsatisfactory breakdowns due to edge flashover and yet not deviate too drastically from the normal B.S. 419 test method, which was essentially a dielectric strength test in air. In this respect an apparatus for narrow tapes described in the Appendix of A.S.T.M. section D.295-55T was examined. The single-shot tester, as illustrated in Fig. 2, is designed to hold a test specimen under pressure between circular rubber washers while the voltage is applied, the pressure to the rubber discs being applied by either compressed air or a lever. This complicated apparatus with its self-aligning spring-loaded electrodes was considered unsuitable and not adaptable for routine testing.

The work in the laboratories, therefore, was concentrated on considering modifications to the B.S. 419

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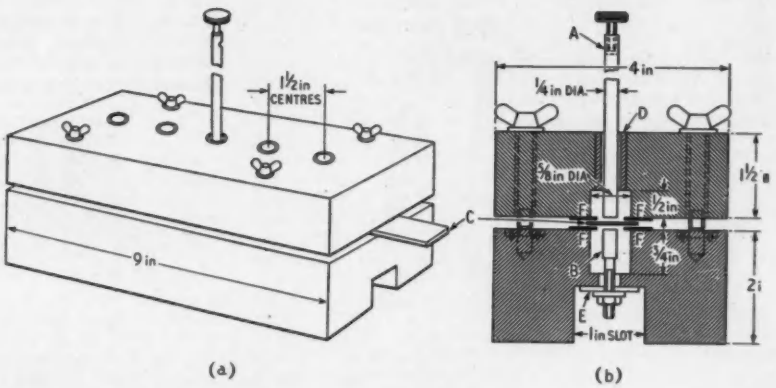


Fig. 1.—Typical example of electrode apparatus for dielectric strength test on insulating tape; (a) General arrangement of apparatus; (b) Section through electrodes with top slightly raised. (The apparatus shown is based on the recommendations of the American Society for Testing Materials)

A. Upper electrode. To be an easy fit in bush D. B. Lower electrode. C. Sample under test. D. Brass bush. Inside diameter just sufficient to clear ¼in rod. E. Brass strip 1in wide connecting all lower electrodes. F. Pieces of varnished cloth strip overlapping edges of sample

electrode configuration initially to enable all widths of silicone rubber proofed woven tapes to be tested and it was decided, in order not to alter substantially the conditions of breakdown, that the upper high voltage ½in diameter electrode should be retained and that the surrounding medium should be air. Modification was, therefore, restricted to the lower earthed electrode, and the possibility of reducing its diameter so that flashover would not occur.

Two methods of overcoming the flashover problem were considered: one was to surround the lower electrode by an insulating oil which would make contact only with the under surface of the test specimen; and the other to increase the effective width of the narrow tape specimens by means of strips of adhesive insulating material applied along their edges. The former method was considered preferable from a routine testing point of view since it did not entail any special preparation of the test samples.

An experimental single-shot tester was therefore made up as shown in Fig. 3 with the lower electrode having a reduced diameter of 0·15in mounted in a short length of 1in internal diameter glass tubing so that it could be surrounded with insulating oil. This lower electrode was arranged so that its top surface was not more than $\frac{1}{16}$in below the top of the surrounding tube. The opposing upper electrode as used in the B.S. 419 apparatus was mounted axially in line with the lower electrode in a freely running bush of sufficient length to ensure accurate alignment, all electrode edges being rounded to a radius of $\frac{1}{32}$in. By this arrangement the bottom surface of the tape specimen was in contact with the oil, but the whole was not immersed. For the silicone elastomer proofed materials this has the advantage of preventing undue absorption of the oil and consequent swelling, providing the length of time in contact with the oil is kept to the minimum.

Using the single-shot tester, comparison tests were conducted with the B.S. 419 apparatus using a 7 and 10 mil thickness silicone rubber proofed woven glass tape material having a short-time dielectric strength of approximately 1·2 kV r.m.s. per mil. The results after conditioning the tape for 24 hours at 75 per cent relative humidity showed good agreement between 1½in width tapes in the B.S. 419 apparatus and various narrow tapes in the experimental tester. With 7 mil material, reliable values could be obtained down to ¼in width tape with only occasional flashover occurring. With the 10 mil material, reliable values could be obtained on tapes down to ¼in in width without trouble, but narrower tapes required a greater number of shots due to an appreciable increase in the occurrence of flashover. In these tests the voltage was raised continuously from zero to breakdown at the rate of 30 kV/min.

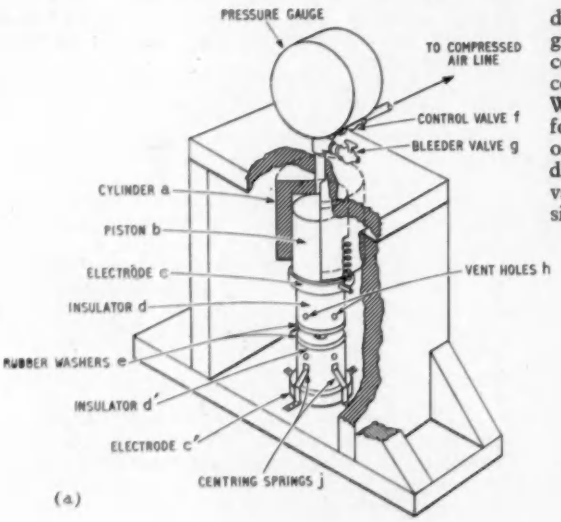
The mechanism of breakdown in tests of this nature has been investigated by the E.R.A. (Technical Report L/T366 "Electrical Insulation" by J. H. Mason, Ph.D., A.Inst.P., A.M.I.E.E., 1957).

The breakdown of the insulating material under test is initiated by electrical discharges which are produced in the air surrounding the edges of the electrodes and impinge on the test specimen. The inception voltage of these surface discharges has been shown to be approximately directly proportional to the square root of the permittivity of the insulating material and also to be dependent on the electrode shape and electric strength and permittivity of the ambient medium. When the space surrounding the lower electrode is filled with oil, discharges beneath the lower surface of the test specimen are prevented, but at the same time the electric stress in the air surrounding the upper electrode is increased; with the silicone rubber proofed material there is very little overall effect on the electric strength.

To enable the modified electrode to be used for routine testing it was decided to incorporate it in the standard B.S. 419 apparatus by replacing the lower electrode assembly with one having the reduced (0·15in) diameter rod electrode, see Fig. 4. A further slight modification was also necessary to make the wells in the lower wooden block oil-tight. The adjustment of the heights of the electrodes in the lower block was found to be critical and the best results were obtained with the top surface of the electrode recessed below the top surface of the lower block by $\frac{1}{16}$in. Further comparative tests were conducted with the B.S. 419 apparatus modified in the manner described, and with the wells in the lower block filled to the top with low viscosity insulating oil. The results confirmed the good agreement achieved with the experimental single-shot tester, and the arrangement was considered suitable for the routine testing of silicone rubber proofed woven glass tapes.

Other Types of Insulating Tapes

The possibility of extending the use of the method developed for the narrow silicone rubber proofed woven glass tapes to other types of insulating tape material was considered worthy of further investigation, and tests were conducted on some of the conventional varnished fabrics. With this type of insulating material, however, it was found that the introduction of insulating oil, although only on the lower surface, had the effect of increasing the dielectric strength values obtained. The conventional varnished fabrics have a much higher permittivity than silicone rubber proofed materials and accordingly a some-



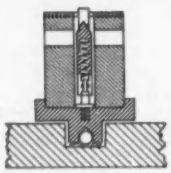


Fig. 2.—(a) Single-shot tester for dielectric strength test on insulating tape. (b) Section of lower electrode showing spring contact, vent holes and self-aligning ball support

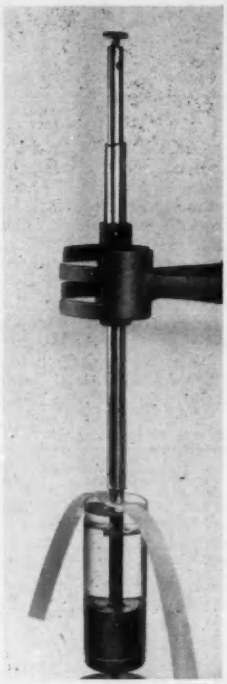


Fig. 3.—Experimental single-shot tester for dielectric strength test on narrow insulating tape

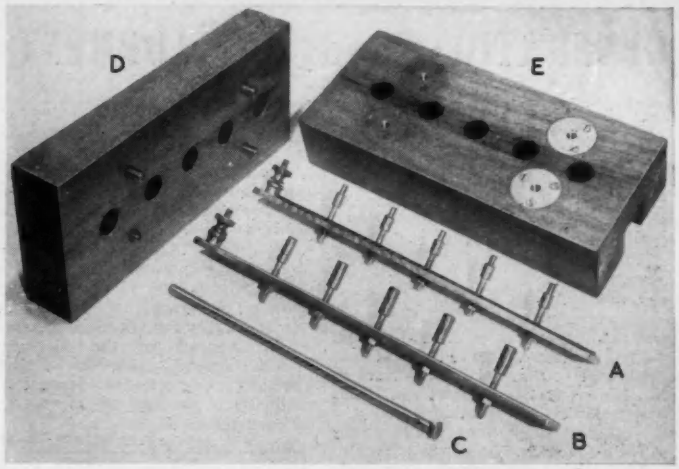


Fig. 4.—Modified B.S. 419 apparatus

A. Modified lower electrode assembly. B. Standard lower electrode assembly. C. Upper electrode. D. Upper block. E. Lower block

what different stress distribution between the electrodes exists when the varnished fabrics are tested; it is thought that this may account for the observed difference in behaviour in the standard and modified tests.

For the varnished fabric materials, therefore, the second method previously referred to was adopted, still employing the modified electrode but dispensing with the insulating oil. To prevent flashover on these narrow tapes, strips of $\frac{1}{4}$in wide, 5 mil pressure sensitive adhesive polythene tape were attached with $\frac{1}{16}$in overlap along both edges of the underside of the test specimen, ensuring adequate space in the centre for positioning over the 0·15in diameter of the lower electrode. By this method tapes down to $\frac{3}{8}$in and $\frac{1}{2}$in wide, respectively, for 7 and 10 mil material, could be tested and the comparative test results using identical material gave good agreement with 1$\frac{1}{2}$in tapes tested in the standard B.S. 419 apparatus. In these tests also, the voltage was raised continuously from zero to breakdown at the rate of 30 kV/min.

By modifying slightly the lower electrode assembly of the standard B.S. 419 dielectric strength apparatus it has been found possible to test silicone rubber proofed tape material of a narrower width than hitherto and obtain good agreement with wide-tape results obtained by the standard method. The method devised was not directly applicable to the varnished cambric type of insulating material, but by using the same modified electrodes and employing an alternative means of preventing flashover, whereby the effective width of the test sample is increased by means of strips of adhesive insulating material, narrow tapes could be tested with the same degree of agreement.

THE ACE COMPUTER

ONE of the world's largest and fastest electronic computing machines has just been put into operation in the Mathematics Division of the National Physical Laboratory, Teddington. Called the ACE (automatic computing engine), it can carry out any calculation process for which exact rules are known. This new machine, with its increased operating speed, its larger storage capacity and its many additional functional facilities, is a considerable advance as a computing tool on its predecessors, the experimental ACE and its engineered counterpart DEUCE.

ACE incorporates many unique design features. The operating mechanism consists of about 6,000 miniature electronic valves, arranged in ten large cabinets. Each cabinet is fitted with electrically operated rising doors to give rapid access for fault finding. Each has a cooling system of circulating air, with heat exchangers and a water cooler.

The computer has three forms of storage, the largest part of which consists of four magnetic drums rotating at 12,000 r.p.m. which will store a total of 32,768 numbers. The access to these numbers is limited by the need to wait for the drum to revolve, and may take up to 7 millisec. These drums are used by the computer for the large amounts of data that it may not want quickly. For more rapid access, a mercury delay line store of 768 numbers is employed. The most rapid access store consists of short delay lines storing one, two or four numbers each.

By good programming the full advantages of the large store can be enjoyed, with a time of access not much greater than is given by the short delay lines. The ACE instructions specify the addresses (the positions in the store) of two numbers to be operated on, the operation, and the addresses of the desired destination of the result and the position of the next instructions. Thus four addresses are used, and all four accesses occur nearly simultaneously. Multiplication and division occur in separate, autonomous devices, so that they can occur simultaneously with the other operations.

In many cases the computer will average 15,000 operations per second, each involving the instruction of two operands (numbers to be operated on), storing the result and extracting the next instruction. Input and output are by punched cards. Magnetic tapes will be fitted later, but will be used as an extension to the store. The input speed from cards will be 7,000 binary digits per second, with an output rate of 450 cards per minute punched in binary.

GENERATION and DEVELOPMENT

C.E.G.B. Contracts

The Central Electricity Generating Board has placed contracts during the past two months for power stations, transmission lines and transforming stations amounting in the aggregate to approximately £5,000,000. They include the following:—

Battersea power station: Extension and modification of 66 kV switchgear.—Metropolitan-Vickers Electrical Co.

Rheidol power scheme: Nant-y-Mooh dam pressure tunnel and Dinas power station.—Cementation Co.

Northfleet substation: Modifications to 132 kV overhead lines.—Watsham's.

Axminster substation: 132 kV switchgear.—Metropolitan-Vickers.

Hatfield substation: Two 90 MVA 132/33 kV transformers.—Ferranti.

Tamworth substation: Two 45 MVA 132/33 kV transformers.—Yorkshire Electric Transformer Co.

West Melton substation: Extension to 275 kV switchgear.—British Thomson-Houston Co.

Pentwortham substation: 132 kV switchgear.—Ferguson Pailin.

Connah's Quay-Trawsfynydd and Trawsfynydd-Ffestiniog: 275 kV double-circuit overhead lines.—Balfour, Beatty & Co.

Weybridge-Chessington Line Approved

The Minister of Power has given his consent to the proposal of the Central Electricity Generating Board to construct a 275 kV overhead line between the Board's West Weybridge substation and a proposed substation at Chessington. This was the subject of a public inquiry held at Kingston-upon-Thames on 20th and 21st May last by the Ministry's chief engineering inspector, Mr. H. W. Grimmitt, and a senior inspector of the Ministry of Housing and Local Government, Mr. W. A. Devereux. Having heard the representations made at the inquiry and inspected the proposed route and alternative routes which had been suggested, the two inspectors recommended that the Board's proposal should be approved, stating that the extra cost of placing any section of the line underground could not in their view be justified.

Output in October

The latest return issued by the Ministry of Power shows that 8,565 million kWh was generated for public supply in October, an increase of 5·9 per cent over the corresponding month of 1957. Although still below the average for the year, this rate was the highest since June. The total capacity of plant installed at 31st October was 27,378 MW, a net increase during the month of 140 MW. This included a 100 MW English Electric set and 830,000 lb/hr boiler at the C.E.G.B.'s Willington "A" station. The North of Scotland Hydro-Electric Board commissioned a 22·5 MW English Electric set at Lochay, a 4 MW Bruce Peebles set at Lubreoch and a 210 kW Gilbert, Gilkes & Gordon compensation set at Stronuich. A 93 kW diesel set at Thurso was taken out of service.

In contrast to the increase in public supply, there was a general decline in electricity generated by industry in the four weeks ended 25th October, the largest decrease (14·4 per cent) being in the textile, leather and clothing industries. The total figure for the industries covered by the return (these do not include railways, transport undertakings, coal mines, gas works or petroleum refineries) was 801 million kWh, a decrease of 6·3 per cent. Production at Calder Hall, included under the chemical industry, was approximately 13 million kWh. In the 43 weeks to 25th October 8,518 million kWh was generated by industry, 0·1 per cent less than in the

ELECTRICITY GENERATED AND PLANT INSTALLED

	Fuel consumed Thousand tons			Electricity generated Million kWh			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity G.B.	3,499	92	311·5	7,837	16	7,858	7,387	24,944
North of Scotland H.E.B. ...	7	—	1·2	11	178	194	193	961
South of Scotland E.B.	240	5	0·1	472	41	513	486	1,473
Total for October, 1958	3,746	97	312·8	8,320	235	*8,565	8,066	27,378
Corres. total for October, 1957	4,032	70	73·7	7,899	178	8,089	7,603	25,861
Inc. or dec., per cent	−7·1	+38·9	+324·7	+5·4	+31·3	+5·9	+6·1	+5·9
Total to date (10 months), 1958	36,745	817	1,882·0	77,283	1,725	79,131	74,430	
Total for corres. 10 months of 1957	36,539	695	381·0	70,943	1,662	72,716	68,314	
Inc. or dec., per cent	+0·6	+17·5	+393·9	+8·9	+3·8	+8·8	+9·0	

* The total figure includes generation by other methods amounting to 10 million kWh.

ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for October (million kWh)			Twelve Months' Totals Ended 31st October (million kWh)		
	1957	1958	Inc. or Dec. %	1957	1958	Inc. or Dec. %
London	621·4	651·9	+ 4·9	7,006·4	7,593·9	+ 8·4
South Eastern	400·5	443·7	+10·8	4,516·4	5,114·5	+13·2
Southern	512·9	582·0	+13·5	5,643·9	6,468·4	+14·6
South Western	249·6	268·9	+ 7·7	2,821·1	3,128·2	+10·9
Eastern	663·2	713·8	+ 7·6	7,317·2	8,120·4	+11·0
East Midlands*	572·6	601·8	+ 5·1	6,253·6	6,754·2	+ 8·0
Midlands*	737·4	785·1	+ 6·5	7,976·6	8,763·6	+ 9·9
South Wales*	431·6	452·6	+ 4·9	4,754·1	5,027·1	+ 5·7
Merseyside and North Wales* ...	445·7	466·3	+ 4·6	4,921·1	5,293·3	+ 7·6
Yorkshire*	744·0	747·7	+ 0·5†	8,157·6	8 609·2	+ 5·5
North Eastern*	432·1	439·7	+ 1·8	4,719·0	5,056·5	+ 7·2
North Western*	768·2	787·7	+ 2·5	8,422·5	8,938·9	+ 6·1
Total all Area Boards	6,579·2	6,941·2	+ 5·5	72,509·5	78,868·2	+ 8·8
Direct Supplies by C.E.G.B. ...	235·6	260·9	+10·7	2,369·2	2,897·7	+22·3
Grand Total	6,814·8	7,202·1	+ 5·7	74,878·7	81·765·9	+ 9·2
Mainly Industrial Areas*	4,131·6	4,280·9	+ 3·6	45,204·5	48,442·8	+ 7·2
Mainly Non-Industrial Areas ...	2,447·6	2,660·3	+ 8·7	27,305·0	30,425·4	+11·4

* Those in which industrial consumers took over 50 % of the total sales in the preceding financial year.
† Yorkshire Board are at present temporarily taking a supply from an outside source. If this is allowed for the change would be +2·7 %.

ELECTRICITY GENERATED AND SENT OUT BY SCOTTISH BOARDS

Board	Totals for October (million kWh			12 Months ended 31st Oct. (million kWh)		
	1957	1958	Inc. or dec. %	1957	1958	Inc. or dec. %
South of Scotland E.B.						
Generated at steam stations ...	496·8	472·2	− 4·9	5,232·3	5,727·0	+ 9·5
Generated at hydro stations ...	27·9	40·5	+45·3	298·9	306·6	+ 2·6
Total generated	524·7	512·7	− 2·3	5,531·2	6,033·6	+ 9·1
Sent out	496·1	486·1	− 2·0	5,236·5	5,710·3	+ 9·0
Net import from C.E.G.B. ...	17·3	31·1	+80·4	406·8	414·1	+ 1·8
Net import from N.S.H.E.B. ...	32·3	58·2	+79·9	427·4	398·7	− 6·7
Total to Area	545·7	575·4	+ 5·4	6,070·7	6,523·1	+ 7·5
North of Scotland H.E.B.						
Generated—Water Power ...	133·7	178·5	+33·5	1,641·7	1,704·5	+ 3·8
Steam	22·5	11·1	−50·3	222·1	263·3	+18·6
Diesel	5·0	5·0	− 1·2	59·3	65·3	+10·0
Total generated	161·2	194·6	+20·7	1,923·1	2,033·1	+ 5·7
Net export to S.S.E.B.	32·3	58·2	+79·9	427·5	398·7	− 6·7
Sent out to Areas	120·8	124·8	+ 3·3	1,382·2	1,512·8	+ 9·5

corresponding period of 1957. The totals for the main industries, in million kWh, were as follows, with percentage increase or decrease in parenthesis:—Chemicals 2,736 (−0·2); iron and steel 1,985 (+6·4); engineering 1,032 (+1·1); textiles, leather and clothing 459 (−12·7); food, drink and tobacco 275 (+5·4); paper 1,736 (−3·3); and other industries 295 (−8·9).

In the separate analysis of electricity sent out for their consumers by Area Boards in England and Wales the national figures show an increase over October, 1957, of 5·7 per cent, but when corrected for weather conditions and working days, the increase is 5·2 per cent.

The third table gives details of electricity generated and sent out by the two Scottish Boards.

Dearer Electricity in Merseyside Area

Higher charges to operate from the first meter readings after 14th February next were announced by Mr. D. H. Kendon, chairman of the Merseyside and North Wales Electricity Board, last week. Under the domestic tariff the primary rate will be increased from 5¼d to 5¾d per kWh (prepayment rate from 6d to 6½d) while the secondary charge will go up from 1d to 1·05d. The primary rate of commercial and industrial block tariffs will also be raised by ¼d, with smaller increases for additional consumption. Other tariffs for large users are to be reshaped so that consumers with low load factors will pay more and those with high load factors less.

Rural Electrification Costs

Sir Ian Horobin, Parliamentary Secretary to the Ministry of Power, paid a two-day visit to the South Western Electricity Board's Area last week. Speaking at a Press conference at Electricity House, Bristol, on Friday, he pointed out that the main problem of rural electrification was that it was becoming increasingly expensive and uneconomic. To connect a rural consumer cost around £240, to which the consumer contributed an average rural development charge of one-half—certainly not more; the balance had to be met by other consumers. He paid a tribute to the progress made by the Board, saying that it was now 1,000 or 2,000 farms ahead of its programme.

The chairman of the South Western Electricity Board, Mr. A. N. Irens, said that the Board was the only one which had a fixed farm tariff charge of £3 5s a quarter "to ensure that we get something back before we start charging the rest." There was an alternative contract rate of 25s a quarter which had been accepted by the farmers' organisations.

Estate Supply Terms

The North Eastern Electricity Board has informed the Darlington Town Council of the terms under which the Board would be prepared to supply electricity, without contribution from the Council, to the Firth Moore estate. The town clerk stated that the terms included conditions not contained in a previous agreement on the subject reached in 1953. The Council has taken up the matter with the Durham County Boroughs' Committee.

Supergrid Line Erection

Between Blackburn and Preston the route of the Carrington-Penwortham-Rochdale 275 kV transmission line being erected by the British Insulated Callender's Construction Co., Ltd., for the Central Electricity Generating Board crosses a wooded valley near Feniscowles. The company was asked to exercise special care to avoid damage to the trees during erection of the conductors between the supporting towers on each side of the valley—a span of 1,600ft. In order to do this a pilot line was fired across the valley by coastguard rocket apparatus and the conductors were then drawn across without damage to the trees.

275 kV line between Carrington, Penwortham and Rochdale. A pilot line being fired by rocket across Stanworth Woods

Sir Ian Horobin, Parliamentary Secretary to the Ministry of Power (centre), with Mr. A. N. Irens, chairman of the South Western Electricity Board (left) and Mr. Shacksford, Private Secretary to the Minister, at a Press conference at Bristol

OVERSEAS

Power from Geothermal Steam

The first turbine at the geothermal station at Wairakei, New Zealand, is now in operation and is expected to produce 6·5 MW. To this will be added progressively other generating units which may build up the output to possibly 151 MW for the first stage of the development. In the next stage it is hoped that a total output of 282 MW will be achieved.

The success or failure of the first unit will be more significant than the amount of power it produces. Engineers in charge of the scheme apparently are well satisfied with the work as far as it has progressed and with the prospects of success on a large scale. The Government's plans for meeting the future power load are dependent upon the successful utilisation of natural steam and for this reason the operation of the first unit at Wairakei is being watched with close interest. One vital question is whether the bores will continue to yield sufficient quantities of steam at high pressure. Tests over a long period have given a large measure of assurance on this point. Large numbers of bores have been sunk and in the meantime it is only a question of selecting the most suitable ones for supplying the turbines.

Lake Macquarie Power Station Opened

The N.S.W. Premier (Mr. J. J. Cahill) officially opened the Electricity Commission's Lake Macquarie power station on 7th November. The station has a planned capacity of 330 MW when completed in 1960.

Commission's New Headquarters

The South African Electricity Supply Commission recently moved to its new 240ft high headquarters in Braamfontein, Johannesburg. The building has 25 floors—20 above ground level and five below.

NEW ELECTRICAL EQUIPMENT

Recording Oscilloscope

The recording oscilloscope Type 1239A manufactured by REDCLIFFE INDUSTRIES (BRISTOL), LTD., Emery Road, Brislington, Bristol, 4, is a high-speed recording instrument intended for viewing and photographically recording fast rising low duty cycle transients of the order of 4 millimicroseconds rise time, either non-recurring or repetitive, and single sweep applications involving transients up to 10 microseconds duration.

Provision is made for high or low impedance trigger with a stable voltage discriminator variable from 2 to 27 V. A paralysis circuit prevents re-triggering until a complete cycle of events (e.g. signal trace, calibration trace and camera operation) has been completed. A probe unit with 4ft of connecting cable is provided for connection to the 20 dB input socket of the low level amplifier.

The cathode-ray tube has a 3in aluminised screen and post deflection accelerator and the trace brightness on the shortest time base is sufficient to give a satisfactory photograph with a standard green sensitive film. A recording camera with a daylight loading 16 mm film cassette is used. The instrument is housed in a fully enclosed steel rack finished in grey stove enamel and mounted on a black enamelled castor base.

Polypole Couplers

Cable coupler systems to interconnect electronic and similar equipment in such applications as studio, outside broadcast and industrial television camera chains, radio relay links, and specialised signalling, remote control, observation and measuring equipment, have been introduced by BRITISH INSULATED CALLENDER'S CABLES, LTD., 21, Bloomsbury Street, London, W.C.1.

The systems comprise multicore cables terminated with moulded-on couplers, and panel-mounting units to which terminated cables may be connected. Couplers consist of a moulding, which is encased in a metallic housing, holding the individual plug and socket contacts in position and providing an anchor for the cable.

Couplers are normally of the plug and socket type, although alternative dual-purpose designs which are identical and interconnectable are available for some systems. Lock rings on the socket type couplers engage with screw threads on the metal housings of the plug type, providing the force necessary to engage or disengage the coupler contacts.

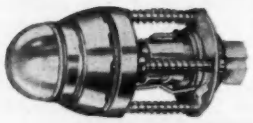
Where necessary, special tools can be provided to ensure correct engagement. Straight and right-angled couplers are available accommodating up to a maximum of 101 circuits.

B.I.C.C. 37-way coupler

Indicator Lamps

Two types of indicator lamp units, for use on circuits up to 250 V or for low voltage circuits not exceeding 24 V, have been introduced by CRAIG & DERRICOTT, LTD., Royal Works, Sutton Coldfield, Warwickshire.

In the high voltage type the bulb is deeply recessed to avoid overheating the glass lens, the lamp and its holder being pulled forward in the mounting to facilitate bulb replacement from the front. Two sealing gaskets are fitted



Craig & Derricott indicator lamp

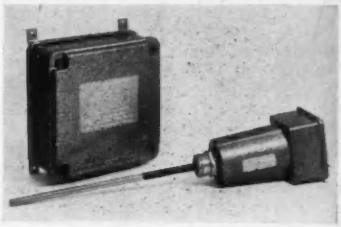
to prevent oil and moisture ingress when used on machine tools or similar applications. The lamp may be mounted on panels up to ¼in thick, and clear or coloured glasses are available. The lenses are designed to afford good visibility from both the front and side and the exterior surface is smooth to prevent dust accumulation and afford easy cleaning.

Transistorised Level Control

In the capacitance operated level control and indication equipment introduced by LANCASHIRE DYNAMO ELECTRONIC PRODUCTS, LTD., Rugeley, Staffordshire, transistor oscillators replace thermionic valves in the detector circuit which registers the change in capacitance at a probe or similar electrode on the approach or recession of a material.

The level detector circuit is housed within the probe head, which can be mounted at any distance from the control unit with only three interconnecting wires. All wiring external to the control unit is at a maximum potential of 12 V d.c. to earth, and the maximum current which can be drawn in the connecting cables under short-circuit conditions is 50 mA d.c.

The probe head unit accepts a



Lancashire Dynamo level control equipment

variety of probes, each having a maximum high frequency current of 1 mA at 6 V r.m.s. The unit is capable of operating for changes of capacitance of ±2 pF in ambient temperatures up to 50 deg C. The equipment is not affected by normal mains supply fluctuations, variations in the differential operating capacitance being not more than ±0·8 pF for a mains voltage fluctuation of ±15 per cent from the nominal.

Feed or alarm circuits include one pair of normally open and one pair of normally closed contacts rated at 5 A 230 V or 1 A 440 V at 50/60 c/s. The unit operates on 200/250 V or 110 V 50/60 c/s single-phase supplies, imposing a load of 30 VA approximately.

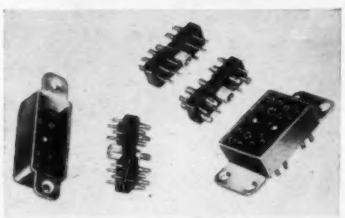
The control unit is housed in a light alloy case measuring 7⅞in by 7⅞in by 4in, suitable for back or base mounting. All units are fully weather-proofed with synthetic rubber gaskets between metal surfaces for sealing.

Miniature Connectors

A range of "Domino" miniature "Unitors" has been introduced by BELLING & LEE, LTD., Great Cambridge Road, Enfield, Middlesex, for use on small equipments where space and weight considerations prevent the use of the standard "Unitor." Three basic plug and socket models are available, comprising two 8-way types with either four small and four large pins or eight small pins, and one 12-way type.

Surface and flush mounting metal shrouds are available to accommodate one, two or three "Unitors," giving a wide choice of pin combinations and

Belling & Lee miniature "Unitors"



arrangements. The body mouldings of black, moisture and tracking resistant, phenolic material are coded on each side of both plugs and sockets in order to facilitate wiring and fault finding.

Plug pins are formed from brass and supplied either gold or silver plated, while socket pins are of beryllium copper, slotted to ensure good contact with the plug member. Each assembly has a locating centre pin and an 8 BA stud is provided for mounting the "Unitor" on a chassis or panel.

A "Unitor" carrying two miniature coaxial connectors and a locating spigot is now under development and is soon to be made available.

Battery Gas Convertor

A device which when fitted in place of the normal filler-caps of an enclosed type, acid or alkaline, battery converts

"Catylator" unit for batteries

the hydrogen and oxygen gases produced by electrolysis back to water is now being marketed by CATYLATORS, LTD., Weydown Road, Haslemere, Surrey. Known as a "Catylator," it is constructed of a plastic material and contains a ceramic cylinder which holds the catalyst, consisting of palladium pellets, in a special compound so that it remains dry. The manufacturers claim that topping-up is reduced by five times, since water losses are confined mainly to evaporation.

Where open type batteries are employed, the "Catylators" may be hung around a battery room where they will still serve to convert the hydrogen given off and reduce the possibility of an explosion. The life of these units is not known but they have been fitted into cells being continuously charged for over five years, some 44,000 hours, without signs of deterioration.

Liquid Heat Pump

Liquid heating plants in sizes up to 3 h.p. and incorporating a hermetically-sealed air-to-liquid heat pump have been added to the range of air-conditioning and refrigeration units manufactured by TEMPERATURE, LTD., Burlington Road, London, S.W.6. The units, which are suitable for operation with outdoor temperatures between 25 and 125 deg F, are rated at 150 g.p.h. with liquid temperatures up to 120 deg F. For industrial processes thermostatic control maintains the selected temperature within close limits between 50 and 120 deg F. A plastic-bodied pump, with a neoprene impeller, will handle a wide variety of liquids at external heads up to 30ft. A heating capacity of 2½ times the total watts input is produced when supplying liquid at 110 deg F, with an outdoor air temperature of 40 deg F.

Micro-Spot Cathode-Ray Tube

A micro-spot cathode-ray tube developed for airborne applications and capable of resolving 5,000 lines is now available from the Electronics Department of FERRANTI, LTD., Hollinwood, Manchester, Lancs.

Measuring 5in across, the 5/71 CM tube has a spot diameter considerably less than one-thousandth of an inch. The high resolution of the tube has been obtained by using an exceedingly fine screen and an electron gun with two focusing elements, one electromagnetic and external to the tube, the other being electrostatic and of fixed

Ferranti micro-spot tube

focal length. The tube has an optical flat face with a non-darkening glass and a short cylindrical bulb, coated—except over the screen surface—with a thick layer of plastic resin, permitting operation under adverse atmospheric conditions, viz. 30 kV at 75,000ft without danger of e.h.t. breakdown.

Whilst the new tube is primarily intended for the display or photography of repetitive information, single transients may be photographed at writing speeds which are limited by the scan coil requirements. The standard phosphor used in the tube has green fluorescence suitable for use with many types of photographic material. Tubes with a blue fluorescence can also be supplied. Scanning and focus coils are available specially designed for use with this tube, and a small alignment magnet is clamped to the neck of the tube in the region of the cathode.

Powered Winches

A range of winches to cover direct loads from ½ ton to 7 tons, with mean rope speeds from 10 to 300ft per minute depending upon the direct load, has been produced by RICHARD C. GIBBINS & CO., LTD., Berkley Street, Birmingham, 1.

Two kinds are available and the specifications include cast iron drums with rope anchorage, worm and spur reduction gears, and solenoid operated brakes capable of sustaining the full load on the rope. Standard winches up to approximately 6 h.p. are fitted with squirrel cage motors and direct-on reversing starters, the larger winches having slipring motors with drum type controllers and resistances.

A limit switch to protect the winch from overwinding may be fitted in conjunction with direct-on starters, or arranged to operate with the circuit-breaker in the case of the drum type controllers. All electrical equipment is in accordance with the appropriate British Standard and, unless otherwise specified, half-hour rated motors are fitted.

Aluminium in Underfloor Heating

An improved economic method of underfloor heating has been introduced by HEATING INVESTMENTS, LTD., of 45, Church Crescent, Finchley, London, N.3. This development employs aluminium foil and sheet to increase the efficiency of the system. The aluminium foil is cemented to ½in thick expanded plastic heat-insulating sheeting, which in turn is cemented to the tongued-and-grooved wooden sub-floor. On top of the foil is laid the warming element, placed between 2in wide hardboard strips. The foil diffuses the heat from the underside of the element, thus eliminating any heat ridging, with a corresponding reduction of downward heat loss.

When the resistance cable has been laid and infilled with a special compound, 3ft square sheets of Noral 3 SH aluminium alloy supplied by the Northern Aluminium Co., Ltd., are cemented on top, spaces being left between the sheets to allow for expansion.

The aluminium alloy sheets are finally covered by fitted carpets, linoleum, or any other form of floor covering as required. Because aluminium is an excellent conductor of heat, a very quick heating response is obtained, in contrast to conventional floor warming systems in which the heating elements are covered with a dense top screed.

Nailing down the hardboard strips locating the resistance wire on the aluminium foil for Heating Investments' underfloor heating system

Financial Section

STOCKS and SHARES

IN the gilt-edged market of the Stock Exchange, prices made a satisfactory initial response to the surprise decision to reduce the Bank Rate to 4 per cent, although the recovery made good only a part of the losses in previous weeks. There was no very marked change on the part of industrial shares, but this further evidence of the Government's concern to stimulate business activity helped to counteract anxiety over the European situation and the mildly reactionary tendency in the market since the middle of this month.

Higher Prices

Allen West 5s shares have been in good demand since the distribution of the 20 per cent scrip issue in the early part of this month. They rose further during the past week to 12s 9d (having been over 13s), with the new shares a fraction higher, being transferable free of stamp duty. On the increased capital, the directors have indicated a final dividend of 7½ per cent for the current year. With the interim dividend paid before the issue, this would make a total equivalent to 11·6 per cent (or about 1½ per cent more than before) and put the shares on a yield basis of just over 4½ per cent. Another good feature in the electrical market was the strength of Telegraph Construction and Maintenance £1 shares, which gained 3s 9d in rising to 32s 6d. Aberdare Holdings 5s shares were again prominent with a further advance of 1s 3d, to 15s 6d.

Mixed Changes

English Electric showed a gain of 1s 3d on the week, to 58s 9d, and Lancashire Dynamo added 2s 6d to the previous week's rise of 1s 3d, moving up to 42s 9d. Decca "A" shares continued to attract buyers up to 33s 9d. British Tabulating Machine remained firm on consideration of the company's dividend and scrip issue proposals, and of the scheme for a merger with Powers-Samas. Others which showed improvement included Bulpitts, Chloride Electrical, Ericsson Telephones, International Combustion and Simon-Carves. On the other hand, reactionary tendencies appeared at some points. There were declines of a shilling or so in Pye, G.E.C., London Electric Wire, Lucas, Johnson & Phillips and Morphy-Richards, and a number of smaller recessions. Shares with commercial television associations remained active on the strength of the £5·1 million profit reported by Associated - Rediffusion. The Anglo-Portuguese Telephone new shares were dealt in at a premium of 3s on the issue price of 24s.

E.M.I. Outlook

In his review accompanying the full report of Electric & Musical Industries for the year ended in June, Mr. J. F. Lockwood believes that the present financial year may prove to be more difficult than the last, during which total sales of the group expanded by 8 per cent, to £66 million. Despite

Price Changes in

Company or Board	Nom. Value	Middle price 24th Nov.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	76½	+½	3	3	3 18 6	76½	72
Brit. Elec. 1974/77	100	73½	+½	3	3	4 1 9	73½	68½
Brit. Elec. 1976/79	100	77	+½	3½	3½	4 10 9	78½	72
Brit. Elec 1974/79	100	87½	+1	4½	4½	4 17 3	87½	82‡
Overseas Electric Supply								
Calcutta Elec.	£1	17/6	+6d	6·8†	7†	8 0 0†	17/6	15/-
East African Power	£1	22/9		7½	8	7 0 3	23/-	17/6
Nigerian Elec.	£1	14/6		10	10	13 16 0	17/-	12/6
Perak Hydro-Elec.	£1	13/6	−6d	12½	10	14 16 3	15/6	13/6
Electrical Shares								
Aberdare Holdings	5/-	15/6	+1/3	17½	17½	5 13 0	15/6	9/9
Aerialite	1/-	8/6		51½	54	6 7 3	8/6	5/1
Allen, W. H.	£1	43/9		10	11	5 0 6	43/9	32/9
Anglo-Portuguese Tel.	£1	26/3		8	9	6 17 3	29/3	19/9
Aron Elec. Ord.	£1	61/3		15	15	4 18 0	61/3	53/-
Assoc. Elec. Ord.	£1	57/6		15	15	5 4 3	57/6	46/6
Automatic Tel. & El.	£1	72/6		17	17	4 13 9	72/6	57/-
Babock & Wilcox	£1	53/9		15	13‡	4 16 9	54/6	41/9
Bakelite	10/-	21/3		15	15	7 1 3	23/-	17/6
Baldwin, H. J.	2/-	3/-		20	20	—	3/9	2/6
Berry's Electric	5/-	10/6		10	10	4 15 3	10/6	5/9
Bowthorpe Holdings	2/-	11/-		37½	25*	4 11 0	11/-	6/6
British Aluminium	£1	59/3	−2/-	12	12	4 1 0	61/3	37/-
Brit. Elec. Traction: Def. Ord. "A"	5/-	38/6		25	25	3 5 0	40/-	19/6
B.I. Callender's	£1	51/-	−6d	12½	12½	4 18 0	52/-	38/9
B.I. Callender's 6% Pref.	£1	20/-		6	6	6 0 0	20/3	19/-
British Tabulating	£1	60/-		9	10	3 6 9	60/6	38/6
British Thermostat	5/-	34/9		25	30	4 6 3	35/3	19/9
British Vac. Cleaner	5/-	4/6		10	10	5 11 0*	4/6	2/3
Brook Motors	10/-	43/9		25	25	—	43/9	27/9
Bulgin, A. F.	1/-	7/-		40	45	6 8 6	7/-	4/7
Bulpitts	5/-	10/6	+3d	—	12½‡	5 19 0	10/6	7/3
Burco Dean	5/-	11/6	+3d	20	22½	6 10 6*	11/6	7/9
Cable & Wireless: Ord.	5/-	13/-		10	10‡*	3 17 0	13/-	8/-
4% Loan	100	94½		4	4	4 4 9	94½	89
Chloride El. Storage "A"	£1	66/3	+1/3	17½	17½	5 5 9	66/3	55/6
Clarke Chapman	£1	64/3		27½	27½	4 5 6	72/6	55/-
Cole, E. K.	5/-	16/9	−3d	17½	17½	5 4 6	18/-	15/3
Cossor, A. C.	5/-	5/6	+3d	2½	Nil	Nil	6/-	4/4
Crabtree	10/-	31/6		20	20	6 7 0	32/-	24/4
Crompton Parkinson	5/-	12/6		16	12*	4 16 0	13/6	8/3
De La Rue	10/-	32/3	+9d	35	17½*	5 7 9	32/3	20/9
Decca "A"	4/-	33/9	+9d	43½	43½	5 3 9	34/6	21/3
Desoutter	5/-	16/6		32½	18½*	5 13 9	16/6	13/6
Dewhurst	2/-	8/9		16½	20	4 11 6	9/-	6/9
Dictograph Tel.	2/-	7/-	−3d	20	20	5 14 3	7/3	4/7
Dubilier Condenser	1/-	3/6		30	20*	5 14 3	4/3	3/1
Duport	5/-	10/9		25	12½*	5 16 3	10/9	7/9
E.M.I.	10/-	56/9	+3/3	15	15	—	54/-	27/6
Electrical Components	5/-	9/3		12½	12½	6 15 3	9/9	7/-
Elec. Construction	£1	28/9		8½	8½	5 18 3	28/9	21/-
Elliott-Automation	5/-	18/3	−1/3	—	10‡	2 14 9	19/9	11/6
Enfield Cable Ord.	£1	17/-		Nil	2½	2 18 9	18/9	10/9
English Electric	£1	58/9	+1/3	14	14	4 15 3	60/-	44/-
English Electric 3½% Pref.	£1	12/6		3½	3½	6 0 0	12/6	11/9
Ericsson Tel.	5/-	25/9	+6d	22†	12*‡	4 1 0	25/3	17/6
Ever Ready	5/-	21/9		37½	20*	4 12 0	22/-	13/9
Falk Stadelmann	£1	43/9		17½	15	6 17 3	46/3	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

intensified competition on the gramophone record sides of the business he is convinced, however, that the group will maintain its position, while on the electronic equipment side he expects continued growth. As already known from the preliminary statement, the group net profit for 1957–58 increased substantially to over £2 million. Although the dividend for that period is being kept at 15 per cent, the intention is to distribute a one-for-three scrip issue and a 20 per cent dividend on the capital so increased. This would be equivalent to 26⅔ per cent on the present amount, and would produce a yield of 4·7 per cent on the shares on the basis of their recent price of 56s 9d.

Electrical Investments

Company or Board	Nom. Value	Middle price 24th Nov.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
Electrical Shares—continued						£ s d		
G.E.C. Ord.	£1	35/-	−1/3	12½	10	5 14 3	40/-	29/3
G.E.C. 6½% Pref.	£1	21/6		6½	6½	6 1 0	21/6	20/3
General Cables	5/-	9/9		30	24	—	11/9	8/3
Greenwood & Batley	£1	55/-	+2/6	17½	20	7 5 6	55/-	45/-
Hackbridge Holdings	5/-	13/9		20	20	7 5 6	14/9	7/6
Hackbridge & Hewittic	5/-	14/-		20	20	7 2 9	14/6	9/7
Head Wrightson	5/-	25/-	+6d	22½	17½*	3 10 0	26/-	16/9
Hestrae	2/-	7/6		15	20	5 6 9	7/6	4/-
Holophane	5/-	15/6		37½	22½*	7 5 3	15/6	12/6
Hoover	5/-	52/-	−1/-	50	50	4 16 3	53/6	31/-
I.C.I.	£1	35/6	−3d	10	12	4 10 3*	36/-	23/9
Intl. Combustion	5/-	28/6	+6d	22½	25	4 9 3	28/3	19/3
Johnson & Phillips	£1	18/9	−1/3	10	5	5 6 9	25/-	15/-
Lancashire Dynamo	£1	43/9	+2/6	11	11	5 0 6	43/9	28/6
Laurence Scott	5/-	16/9		15	15	4 9 6	16/9	12/6
Lister, R. A.	£1	31/6		10	10	6 7 0	31/6	23/-
London Elec. Wire	£1	62/6	−1/3	12½	12½	4 0 0	64/6	39/6
Lucas, J.	£1	42/6	−1/3	7½	10‡	4 14 3	45/-	27/9
Marconi Marine	£1	38/9		10	10	5 3 3	38/9	29/-
Marryat & Scott	2/-	7/-	−6d	35	37½	5 7 3*	7/7	5/3
Mather & Platt	£1	50/6	+6d	15	15	3 19 3*	50/-	29/6
Metal Industries	£1	43/3	+9d	9	14	6 9 9	44/-	22/9
Midland Elec. Mfg.	£1	62/6	+2/6	12½	12½	—	62/6	44/-
Morphy-Richards	4/-	17/6	−1/3	20	20	4 11 6	19/-	14/6
Murex	£1	52/6		20	17½	6 14 0	59/3	48/-
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/3
Oldham & Son	1/-	3/-		17½	17½	5 16 9	3/-	2/3
Parsons, C.A.	£1	55/-		8½	7½*	2 14 6	55/-	43/-
Plessey	10/-	67/6		30	30	4 9 0	72/6	55/-
Pye	5/-	15/6	−1/6	12½	12½	4 0 9	17/-	10/-
Pyrotenax	5/-	32/6	−1/3	—	27½‡	4 4 6	33/9	27/6
Reyrolle	£1	88/9		17½	17½	3 19 0	88/9	73/6
Rheostatic	4/-	7/6		12½	12½	6 13 3	8/-	6/-
Richardsons Westgarth	10/-	14/9		16⅔	8⅓*	5 13 0	15/9	13/-
Scottish Cables	4/-	11/9		27½	27½	5 8 9*	11/9	7/-
Simon-Carves	5/-	30/6	+6d	20	25	4 2 0	30/6	22/6
Smith (England), S.	4/-	11/-		20	12½*‡	4 11 0	12/3	7/-
Southern Areas	£1	12/6		7½	Nil	Nil	13/9	9/3
Strand Elec.	5/-	9/-	−3d	15	15	8 6 9	9/3	4/9
Sturtevant	5/-	18/3	−9d	15†	15†	7 3 6	19/6	14/9
Sun Elec.	£1	60/6	+6d	25	25	8 5 3	60/6	47/3
Switchgear & Cowans	5/-	8/9		25	22½	6 8 6*	8/9	4/6
Taylor Tunnicliff	5/-	17/3		15	17½	5 1 6	17/3	11/9
T.C.C.	10/-	37/6		25	25	6 13 3	38/6	32/6
T.C. & M.	£1	32/6	+3/9	8½	8½‡	5 4 6	32/6	20/-
Telephone Mfg.	5/-	4/6	−1/-	10	10	11 2 3	5/9	4/6
Telephone Rentals	5/-	12/9		12½	12½	4 18 0	13/6	9/9
Thompson (John)	5/-	25/-		25	25	5 0 0	27/-	23/-
Thorn Elec. "A"	5/-	23/3		17½	17½	3 15 3	23/3	17/-
Thornycroft	£1	23/9		12½	7½	6 6 3	30/9	21/-
Tube Investments	£1	77/6	+2/-	15	17½	4 10 3	78/9	48/3
Vactric	5/-	26/3		25	25	—	—	—
Veritys	5/-	5/3		12½	2½	2 7 6	6/9	5/3
Walsall Conduits	4/-	17/9		20	22½	5 1 6	17/9	11/-
Ward & Goldstone	5/-	34/6		40	25*	3 12 6	34/6	23/6
Watford	2/-	7/6		25	25	5 6 9*	7/6	4/-
Westinghouse	£1	43/9	+1/-	18	10*	4 11 6	43/9	32/3
West, Allen	5/-	12/9	+3d	15	12½*	—	13/-	7/9
Wolf Electric	5/-	8/3		20	10*	6 1 3	9/-	6/9

Interim Announcements

Elliott Automation 5s shares lost 1s 3d of previous much larger gains after the declaration of a 4 per cent interim dividend and the intimation that an advance in the year's total distribution beyond 10 per cent was not to be expected. In announcing the maintenance of the interim dividend at 2½ per cent, Telephone Manufacturing referred to poor trading conditions; the directors advised shareholders that profits in the first three quarters of the current year dropped to £42,000 against £179,000 for the same period of 1957, and that any final dividend would have to be considered in relation to the full results and further prospects. Dividends of 10 per cent have been paid regularly for many years. There was a fall of 1s in the price of the 5s shares, to 4s 6d.

Wilkins & Mitchell

There was an overwhelming response recently to the offer of over a million 5s ordinary shares of Wilkins and Mitchell, manufacturers of power presses and the "Servis" domestic washing machines, at a price of 8s per share. They stand now at about 10s 6d, and will be transferable free of stamp duty until the middle of next month. According to the prospectus, profits for the present year, ending in March, are expected to be at least level with the £362,000 (before tax) earned in 1957–58. On this assumption the directors anticipate a total distribution of 13 per cent. This would give a yield of 7½ per cent on the shares at their present price.

Dividends & Results

The 12½ per cent total dividend on Duport 5s shares, for the year ended in July, is equivalent to the rate paid previously on half the present capital of £3¾ million. As forecast by the company at the halfway stage, group trading profits were lower at £1·4 million; but the contraction is of only very minor dimensions, and after a reduced tax charge the net balance comes out slightly higher at £687,000. From the preliminary figures, this appears to provide 2¼ times cover for the dividend, on which the 5s shares at 10s 9d yield just over 5¼ per cent. Sun Electrical report little change in the net profit, at £60,000, and are again bringing up the dividend to a total of 25 per cent. The £1 shares, in which transactions are recorded comparatively seldom, are quoted at a little over £3 to yield 8¼ per cent. Hackbridge & Hewittic report that net profits for the first half of the current financial period were approximately the same as the previous corresponding figures.

REPORTS and DIVIDENDS

The Solartron Electronic Group, Ltd.—The annual meeting was held on 17th November, Mr. J. Bolton (chairman and managing director) presiding.

In his review of the activities of the group during the year ended 30th June, which had been previously circulated to shareholders, Mr. Bolton said that the highlights of the year included a substantial increase in trading profits; export deliveries were 50 per cent up on the previous year; and orders received again expanded faster than deliveries and further orders were received from N.A.T.O. for radar simulators. The first phase of the new factory at Farnborough had been completed. A wholly owned German subsidiary, Solartron Elektronik G.m.b.H., had been formed and in Great Britain Solartron-Rheem, Ltd., was formed as a joint development company with the Rheem Manufacturing Co., of New York. A number of developments had become established as world leaders in their particular fields, and production was commenced on major new items which further broadened the base of the company's sales. With substantially enlarged production facilities, a growing order book and successful new products with an international market, they looked forward in the current year to a further expansion of approximately 50 per cent in both deliveries and orders received.

The 1958-59 programme was part of an overall plan which aimed at achieving a carefully controlled expansion to several times the present size during the next five years. In order to provide the necessary finance for the 1958-59 programme, the directors had decided to make further issues of ordinary shares. The remaining unissued 10s ordinary shares would first be issued privately at £10 per share, so as to facilitate the provision of finance for the new factory and generally strengthen the sources of outside capital available in the future. Having completed this issue, a rights issue of 10,000 new 10s ordinary shares was then proposed on the basis of one new share for every 10 ordinary shares held, again at a price of £10. When both these issues were completed, it was then recommended that a three-for-one capitalisation issue should be made out of share premium account and capital reserves. On completion of all these issues, the ordinary share capital would be £220,000.

Electric & Musical Industries, Ltd.—In his statement, which has been circulated with the report and accounts for the year to 30th June last, Mr. J. F. Lockwood (chairman) says that the total sales of the group amounted to £66 million, an increase of 8 per cent on the preceding year. This figure excludes the radio and television products being sold under the His Master's Voice and Marconiphone trade marks by the British Radio Corporation, Ltd., which is jointly owned by E.M.I. and Thorn Electrical Industries, Ltd.

Dealing with research, the chairman says that work continues on television camera tubes, photomultipliers, storage tubes, and on colour television for closed circuit application. While maintaining the volume of its work for the Government, E.M.I. Electronics, Ltd., is giving increased attention to industrial and commercial work. This change in emphasis has called for an expansion of production facilities and some additions to the laboratories. In the field of digital computers, great progress has been made since his last review in producing two data processing machines which are amongst the most advanced in the world.

A large proportion of their output of machine tool control systems is being exported, notably to the highly competitive markets of Europe and North America. A new wide band general purpose oscillograph, designed to meet the specifications of the North American and other important industrial markets, has been successful. For television, they have a new range of studio equipment including a camera which they believe to be in advance of any others on sale at the present time. In the course of the year orders for television studio equipment have been obtained from the B.B.C. and all the newly appointed commercial television programme contractors. Mr. Lockwood refers to the activities of the other companies in the group and to the progress of the overseas companies.

The Perak River Hydro-Electric Power Co., Ltd.—The annual meeting was held on 20th November. In his circulated statement, Mr. H. G. Balfour (chairman) said that as 85 per cent of the company's output was taken by the tin mining industry, the tin restriction scheme had, and continued to have, an adverse effect on their operations. Electricity generated during the year under review totalled 376·9 million kWh, a decrease of 15 per cent on the previous year. The Chenderoh station generated 174·7 million kWh, a decrease of 12½ per cent, due to the lower effective river flow, and electricity generated at Malim Nawar and Batu Gajah decreased from 243·8 million kWh to 202·2 million kWh, owing to the falling off in the tin mining load. The thermal efficiency of the two steam stations per kWh generated increased from 18·25 per cent to 18·81 per cent. The first of the two 12 MW sets which were being installed at Malim Nawar power station would be commissioned by the end of the present year and the second set was expected to be commissioned early in 1959. Consideration of the replacement of older plant by further generating plant had been deferred until the duration and effect of the tin restriction scheme could be more closely assessed.

Joseph Lucas (Industries), Ltd.—The consolidated trading profit for the year ended 31st July last amounts to £6,873,545, as compared with £5,622,381 for 1956-57. After adding other income of £396,665 and exceptional items amounting to £70,264, and deducting £5,098,518 for taxation, the net balance is £2,241,956 (against £1,668,275), of which £1,404,988 is dealt with in the accounts of the parent company. It is proposed to pay a final dividend of 5 per cent, making 7½ per cent for the year, and also to pay a special interim dividend of 2½ per cent. For 1956-57, the total dividend was 7½ per cent, and in addition 1¼ per cent, tax free, was paid out of the surplus arising on the sale of investments in industrial companies outside the group.

Camp Bird, Ltd., reports a consolidated trading profit, subject to audit, of £1,018,822 for the year ended 30th April last, as compared with £657,856 for the preceding sixteen months. Taxation requires £254,950 and, after meeting other charges, the net balance is £323,890 (against £125,122). It is proposed to pay a final dividend of 10 per cent, making 20 per cent for the year on capital increased by acquisitions. A similar total was paid for the previous sixteen months.

Duport, Ltd.—The group trading profits for the year ended 31st July last amounted to £1,432,979, as compared with £1,566,064 for 1956-57, and after providing £745,625 for taxation, the net balance is £687,354 (against £668,547). The proposed final dividend is 7½ per cent, making 12½ per cent for the year on capital doubled by a scrip issue. The total for the previous year was 25 per cent on the smaller capital.

The Sun Electrical Co., Ltd., reports that after deducting £60,998 for taxation, the net profit for the year to 30th April last is £60,173, as compared with £60,001 for the preceding year. The dividend for the year is maintained at 25 per cent with a final payment of 20 per cent. The balance carried forward is £172,160 (against £149,383 brought in).

Yarrow & Co., Ltd., report a group net profit, after providing £255,000 for taxation, of £199,518 for the year ended 30th June last, as compared with £218,811 for the preceding year. General reserve receives £100,000 and the dividend for the year is maintained at 17½ per cent.

Oliver Pell Control, Ltd., reports that after deducting £19,687 for taxation, the profit for the year ended 31st March last amounts to £18,930, as compared with £26,310 for the preceding year. The dividend for the year is maintained at 6 per cent and

£100,162 is carried forward (against £65,267 brought in).

The Hackbridge & Hewittic Electric Co., Ltd., reports that the net profit, before taxation, for the six months to 30th September last, at £191,000, is approximately the same as for the corresponding period of the previous year. An interim dividend of 5 per cent (unchanged) has been declared.

The Cambridge Instrument Co., Ltd., proposes to capitalise £394,594 of reserves and to make a free issue of ordinary shares to ordinary shareholders on a basis of one for two. The new shares will rank *pari passu* with existing shares for any dividend declared after 31st December next. This will include any final dividend declared for 1958. It is stated that it must not be inferred that the total distributed on the ordinary shares will be increased. It is also proposed to increase the capital to £1,500,000 by the creation of 500,000 ordinary £1 shares. The proposals are to be submitted to an extraordinary meeting to be held on 8th December.

Vactric, Ltd., are paying an interim dividend of 12½ per cent (against 10 per cent), and propose to capitalise £50,000 by issuing one "A" (non-voting) ordinary share for every nine ordinary or "A" ordinary shares held. The new shares will not rank for the interim dividend now declared.

Associated Electrical Industries, Ltd., has declared a third interim dividend of 2½ per cent, making 7½ per cent to date (unchanged).

Worthington-Simpson, Ltd., are paying an interim dividend of 7½ per cent (against 10 per cent) on doubled capital.

Enfield Rolling Mills, Ltd., is maintaining its interim dividend at 2½ per cent.

The Telephone Manufacturing Co., Ltd., is paying an interim dividend of 2½ per cent (unchanged).

Elliott-Automation, Ltd., has announced an interim dividend of 4 per cent.

Efco, Ltd., has declared an interim dividend of 5 per cent (unchanged).

New Companies

Electro Marine Engineering Co., Ltd.—Registered 16th October. Capital £2,500. Electricians, mechanical and marine engineers, etc. Directors: W. H. Burrows and Edith E. Lane. Regd. office: 96, Southdown Avenue, W.7.

Wheeler & Higgins, Ltd.—Registered 20th October. Capital £100. Electrical and electronic consultants and engineers, etc. Directors: T. A. W. Wheeler and K. A. Higgins. Regd. office: Station Works, Station Road, Knebworth, Herts.

Ryefield Engineering Co., Ltd.—Registered 24th October. Capital £1,000. Manufacturers of and dealers in and repairers of electrical fuses, valves, etc. Directors: J. Richardson, L. W. G. Garrad and F. W. Blackwell. Regd. office: Cadmore Industrial Estate, Delamare Road, Cheshunt.

C. W. Beckerleg, Ltd.—Registered 23rd October. Capital £100. Manufacturers, repairers, servicers and hirers out of and wholesale and retail dealers in radio, electrical and mechanical apparatus of all kinds, etc. Directors: C. W. Beckerleg and Mrs. Sheila A. Beckerleg. Regd. office: 1, Market Street, Tavistock, Devon.

Dynalectric Tools, Ltd.—Registered 27th October. Capital £100. To manufacture, export, import and otherwise deal in electric tools of all kinds, etc. Directors: C. R. Moss and Mrs. Shirley M. Moss. Regd. office: 39, St. James's Street, S.W.1.

Oldfield Electrical Supplies (Bradford), Ltd.—Registered 27th October. Capital £5,000. Wholesale electrical factors, manufacturers, importers and exporters of and dealers in television and radio receivers and transmitters, etc. Directors: W. R. Oldfield and L. G. Marshall. Regd. office: 24a, Barry Street, Bradford, 1.

Clarrow Marketing, Ltd.—Registered 27th October. Capital £100. Manufacturers, designers, suppliers, repairers, agents and factors of and dealers in electrical apparatus, etc. Directors: C. H. Neilson and Mrs. Enid Neilson. Regd. office: 44, King Street, Manchester, 2.

Bartlett & Hillier, Ltd.—Registered 27th October. Capital £1,000. Manufacturers of and dealers in radio, electrical and mechanical apparatus of all kinds, etc. Directors: I. M. Bartlett and E. W. Hillier. Regd. office: 14, Howick Place, S.W.1.

Tungsten Manufacturing Co. (Sales), Ltd.—Registered 31st October. Capital £100. Solicitors: D. J. Freeman & Fraser, 9, Cavendish Square, W.1.

Bankruptcies

C. L. Philpott, 55, High Street, Walton-on-Naze, Essex, radio and electrical dealer.—Order made 15th October suspending bankrupt's discharge until 15th November.

T. Evans, 25, North Parade, Aberystwyth, trading as Tom Evans Electricals, electrical engineer.—First dividend of 1s in the £, payable on and after 8th December at 106, Walter Road, Swansea.

F. W. Ames, lately carrying on business at 20, Longford Road, Bognor Regis, electrical engineer.—Application for discharge to be heard on 3rd December at the Court House, Church Street, Brighton.

C. R. W. Rowed and **A. E. Smith,** 1, Alexandra Road, Ellacombe, Torquay, electrical engineers and house decorators, trading as Rowed & Smith. (Separate application of C. R. W. Rowed).—Order made 10th October suspending discharge for seven days.

H. M. Pollen, lately carrying on business as a radio and electrical engineer under the style of Thameside Electrical Services, at 51, Thames Street, Staines, Middx.—Trustee, Mr. N. W. Osborne, Bank Chambers, 1, John Street, Bedford Row, London, W.C.1, released 12th September.

A. J. Sweeny, 86, Albert Road, South Norwood, London, S.E.25, electrical contractor.—Trustee, Mr. W. J. W. Hill, 58-61, York Terrace, Regent's Park, London, N.W.1, Official Receiver, released 12th November.

M. Neidle, 26, Elmer Gardens, Edgware, Middx., lately trading as electrical contractor.—First meeting 2nd December and public examination 30th January, both at Bankruptcy Buildings, Carey Street, London, W.C.2.

C. T. Pratt, lately carrying on business at 396, Essex Road, London, N.1, manufacturer of hardware and electrical fittings.—Public examination 16th January at Bankruptcy Buildings, Carey Street, London, W.C.2.

C. Sykes, 10, High Keppleway, Broughton-in-Furness, electrician.—Last day for receiving proofs for dividend 3rd December. Trustee, Mr. D. Atkinson, 14, Lowther Street, Carlisle, Official Receiver.

Liquidations

Hanwell Electrical Supplies, Ltd., radio, television and electrical dealers, Walter House, 418-422, Strand, London, W.C.2.—Winding up. Liquidator, Mr. A. W. Hunter, Walter House, 418-422, Strand, London, W.C.2, appointed 30th October.

W. A. Gooding & Sons, Ltd., electrical contractors and sheet metal workers, 43-44, Upper Russell Street, Brighton, Sussex.—Winding up voluntarily. Liquidator, Mr. A. G. J. Horton-Stephens, 7, Pavilion Parade, Brighton, appointed 8th November. Particulars of claims to the liquidator by 10th December. This notice is purely formal. All known creditors have been, or will be, paid in full.

T. Raymond Hodson, Ltd., electrical contractors and dealers, Guild Buildings, Cattle Market, Brook Street, Preston.—Winding up voluntarily. Liquidator, Mr. G. H. Eaves, 47, Mosley Street, Manchester, 2, appointed 13th November.

Street Lighting Notes

In his latest report, Mr. E. E. Smith, M.I.E.E., F.I.E.S., city lighting engineer of **Liverpool,** shows that the total mileage of lighted streets and passages at 31st March last was 968 (electric 616; gas 352). In the last three years 1,934 gas lamps have been taken out of service and 3,221 electric lamps brought into use, while in the current year it is planned to replace a further 670 gas lamps by 1,160 electric lamps. So far the conversion scheme has cost £128,608 and the whole programme, spread over 10-15 years, will cost about £600,000.

A good example of reduced maintenance costs with improved lighting efficiency is at **Caterham,** Surrey, where fifty-three Atlas "Alpha One" 140 W lanterns have recently been installed to replace 300 W tungsten filament lanterns. Light output of the new installation is 4,720 lumens per 100ft, compared with 1,960 lumens for the previous installation.

Grimsby Town Council has approved an expenditure of £7,764 on new lighting of Class 1 roads in the town.

Fowey Borough Council decided on 4th November that from the end of March next street lighting should be all-electric. The cost of conversion is £1,040.

Exmouth Council has agreed to a £16,500 scheme for improved street lighting.

The General Works Committee of **Oswestry** Town Council recommends the carrying out of the first stage of a £15,556 street lighting scheme. This section includes the areas of Salop Road, Middleton Road, Victoria Road, York Street and Willow Street, the estimated cost of the improvements being £5,475.

Great Yarmouth Highways and Public Lighting Committee has approved a scheme submitted by the borough engineer for the installation of fluorescent lighting in King Street and St. Peter's Road at an estimated cost of £4,760.

Bootle Corporation is applying for sanction to borrow £4,684 for sodium street lighting.

A new street lighting scheme in **Colwyn Bay** is estimated to cost £80,000.

Stockton-on-Tees Town Council is to spend £3,300 providing street lighting in Norton High Street. Sodium lighting units will be installed.

Darlington Town Council has received £3,032 loan sanction for sodium lighting in Geneva Road and £720 for similar lighting in Duke Street.

Chelmsford Roads Committee recommends approval to a scheme submitted by the borough engineer for the improvement of lighting in Moulsham Street and New London Road, at an estimated cost of £7,320.

Scarborough Town Council has received loan sanction for £12,500 for converting street lighting from gas to electricity.

Conversion to electricity of the street lighting in residential areas, at an estimated cost of £5,000, has been approved by **Canvey** U.D.C.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1950

2679. Electric & Musical Industries, Ltd. —Computing apparatus. 19th January, 1951. (804905.)

1951

9107. Electric & Musical Industries, Ltd. —Potentiometers and especially apparatus employing potentiometers for evaluating the rate of change of a variable. 8th April, 1952. (804906.)

1953

19831. Electric & Musical Industries, Ltd.—Apparatus for evaluating the rate of change of a variable. 9th July, 1954. (804907.) 25141. Rate evaluating apparatus. 20th August, 1954. (Addition to 804905.) (804908.) 26279. Apparatus for converting cartesian components of displacement into polar components representing speed and course. 24th September, 1954. (804909.)

1954

6888. South Western Electricity Board, and Snow, L. T.—Electric circuit control devices for automatically reclosing circuit-breakers. 9th March, 1955. (804912.)

7443. Cathodeon, Ltd.—Photo-conductive pick-up tubes. 14th March, 1955. (804911.)

7542. Electric & Musical Industries, Ltd. —Coupling networks for wideband electronic amplifiers. 9th March, 1955. (804860.)

7603. West & Co., Ltd., A., and Stacey, J. R.—Electric motor control systems. 31st May, 1955. (805002.)

9282. Hunt (Capacitors), Ltd., A. H.—Sealing of capacitors and other electrical components. 30th March, 1955. (Cognate application 15742, 27th May, 1954.) (804794.) 9334. Terminal connections for electrical capacitors. 29th March, 1955. (804795.)

16339. Electroflo Meters Co., Ltd., and Engel, F. V. A. E.—Control systems. 31st August, 1955. (Cognate application 17878, 17th June, 1954.) (804812.)

25426. British Telecommunications Research, Ltd.—Electrical pulse generation. 30th August, 1955. (804796.)

36300. Pye, Ltd.—Electronic amplifier circuits. 15th December, 1955. (805092.)

1955

4139. Beltrami, A.—Waveform generators. 11th February, 1955. (805093.)

4690. Hivac, Ltd.—Circuit arrangements for cold-cathode gas-discharge tubes. 30th March, 1955. (805094.)

5898. General Electric Co., Ltd.—Vapour electric arc convertors. 9th February, 1956. (805095.)

8757. Metra Blansko, Narodni Podnik.—Apparatus for testing current or voltage transformers. 25th March, 1955. (804915.)

12810. Licentia Patent-Verwaltungs-G.m.b.H.—Device for recording transient electric voltages. 3rd May, 1955. (804940.)

13227. Kerag Kesselschmiede Apparate- und Maschinenbau.—Electrical glow-discharge ozoniser. 6th May, 1955. (805035.)

14709. Norden-Ketay Corporation.—Magnetic amplifier circuit arrangements. 21st May, 1955. (804951.)

15116. Berghaus, B.—Process and apparatus for carrying out reactions by the action of electrical glow-discharges. 25th May, 1955. (804916.)

15579. Hazeltine Corporation.—Phase detectors. 31st May, 1955. (804917.)

16342. Chromatic Television Laboratories, Inc.—Colour television receivers. 7th June, 1955. (805037.)

16448. Igranic Electric Co., Ltd.—Control means for electrically power operated machines. 8th June, 1955. (804835.)

16746. Philips Electrical Industries, Ltd. —Compandor circuits. 10th June, 1955. (804801.) 16747. Electrical compandor circuits. 10th June, 1955. (804802.)

20519. International Business Machines Corporation.—Electronic counters for use in digital data storage systems. 15th July, 1955. (804808.) 20520. Electrostatic storage system. 15th July, 1955. (804809.)

20826. Standard Telephones & Cables, Ltd.—Lead through capacitor with a metallised electrode. 19th July, 1955. (805096.)

22538. Rototast Electronic Controls, Ltd. —Apparatus for controlling the operational movements of machines. 5th August, 1955. (805039.)

37448. General Electric Co.—Cavity resonators. 30th December, 1955. (804862.)

1956

1719. General Electric Co., Ltd., Norris, E., and Runciman, R. D.—Methods of manufacturing electrical apparatus of the kind comprising a printed circuit panel. 16th January, 1957. (805054.)

2056. Central Electricity Generating Board, Martin, R. E., Prewett, J. N., and Hasler, E. F.—Liquid-level indicators and liquid-level control devices. 12th March, 1957. (804855.)

2059. Wild-Barfield Electric Furnaces, Ltd.—Production of atmospheres for the gaseous cementation of ferrous alloys. 21st January, 1957. (Addition to 748320.) (804864.)

2755. Siemens & Halske A.G.—Coaxial electric cables. 27th January, 1956. (804887.) 20261. Devices for coupling coaxial cables to balanced circuits. 29th June, 1956. (804926.)

8699. Bendix Aviation Corporation.—Capacitance bridge oscillator. 20th March, 1956. (804901.)

11333. General Electric Co.—Electrolytic capacitors. 13th April, 1956. (804866.)

19782. Sylvania Electric Products, Inc.—Processing phosphor screens for cathode-ray tubes. 26th June, 1956. (804958.)

21759. Siemens-Schuckertwerke A.G.—Methods and circuits for initiating electric discharges. 13th July, 1956. (Addition to 792394.) (804841.)

24573. Brown, Boveri & Cie. A.G.—Turbo-generator rotors. 10th August, 1956. (804928.)

26732 and 29690. Standard Telephones & Cables, Ltd.—Multiple contact switches. 31st August and 28th September, 1956. (Additions to 781553.) (804979/80.)

27458. Busch-Jaeger Dürener Metallwerke A.G.—Electric plug having a built-in switch. 7th September, 1956. (804960.)

31263. Roudowsky, G.—Device for neutralising charges of static electricity. 15th October, 1956. (804931.)

33525. Pye, Ltd.—Voltage supplies in television apparatus. 2nd November, 1956. (804932.)

1957

439. Philips Electrical Industries, Ltd.—Variable electric resistances. 4th January, 1957. (804898.)

2908. Klein, A., and Bach, E.—Electromagnetic vibratory contact rectifier. 28th January, 1957. (804845.)

3344. Siemens-Schuckertwerke A.G.—Coil carriers, intended for use in magnetic amplifiers. 30th January, 1957. (804827.)

4653. Coq N.V.—Electric apparatus e.g. switches for high tension. 11th February, 1957. (805077.)

4750. Admiral Corporation. — Synchronous detectors for electrical signalling. 12th February, 1957. (804871.)

8358. Ericsson Telephones, Ltd.—Electron-discharge valve trigger circuits. 13th March, 1957. (805060.)

11188. Standard Telephones & Cables, Ltd.—Multi-band radio receivers. 5th April, 1957. (804874.)

1958

6424. British Telecommunications Research, Ltd.—Electrical pulse generation. 30th August, 1955. (Divided out of 804796.) (804797.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 5th December:—

GENERAL RADIO CO. No. 758,835. Class 9. Electrical instruments and apparatus for measuring and testing, and apparatus and instruments for testing electrical equipment; and parts.—General Radio Co., Cambridge, Mass., U.S.A. Address for service, c/o Frederick J. Cleveland, 303, Bank Chambers, 329, High Holborn, London, W.C.1.

ORWOCOLOR. No. 768,045. Class 9. Scientific and electrical apparatus and instruments; measuring, photographic, cinematographic, radio and television apparatus and instruments; and magnetic tapes, magnetic wires and magnetic discs, all for use as sound recording media. — Veb Filmfabrik Agfa Wolfen, Wolfen, Bitterfeld, Germany. Address for service, c/o Abel & Imray, Quality House, Quality Court, Chancery Lane, W.C.2.

DECCA (design). No. 775,474. Class 9. Gramophones, radio-gramophones, radio and television receiving apparatus, etc.—Decca Record Co., Ltd., 9, Albert Embankment, London, S.E.11.

TYPOTRON (design). No. 778,862. Class 9. Cathode ray tubes.—Hughes Aircraft Co., Culver City, Cal., U.S.A. Address for service, c/o Carpmaels & Ransford, 24, Southampton Buildings, Chancery Lane, London, W.C.2.

CATALOGUES AND LISTS

DATA-PROCESSING SYSTEM. — 18-page booklet describing the "Pegasus" electronic data-processing system.—**Ferranti, Ltd.**, Hollinwood, Lancs.

INSTRUMENTS.—40-page catalogue of electrical and electronic testing instruments.—**Avo, Ltd.**, Avocet House, 92-96, Vauxhall Bridge Road, London, S.W.1.

Eight loose-leaf catalogue pages dealing with flow and control components, etc.—**Bailey Meters & Controls, Ltd.**, Purley Way, Croydon.

Descriptive leaflet (62) dealing with the company's type W.S.3 precision Wheatstone bridge.—**Croydon Precision Instrument Co.**, Hampton Road, West Croydon, Surrey.

INSULATING MATERIALS.—24-page catalogue illustrated in colour describing the company's range of insulating products for the electrical industry in mica, laminated plastics and glass and woven cloths.—**Langley London, Ltd.**, Kelvin Way, Crawley, Sussex.

JOINTING COMPOUNDS.—Illustrated booklet describing some of the functions of "Denso Mastic" permanently resilient cold filling and jointing compounds.—**Winn & Coales, Ltd.**, Denso House, Chapel Road, London, S.E.27.

SILICONE RUBBERS.—26-page illustrated booklet containing a summary of the grades, properties and applications of I.C.I. silicone rubbers, including examples of their use in the electrical industry.—**Imperial Chemical Industries, Ltd.**, Ardeer Factory, Stevenston, Ayrshire.

SPACE HEATING.—Priced 20-page catalogue (423), illustrated in colour, of the range of MEM domestic electric heating appliances. —**Midland Electric Manufacturing Co., Ltd.**, Reddings Lane, Tyseley, Birmingham, 11.

SURFACE HEATERS. — 44-page illustrated catalogue (ELT/58) of electric surface heaters for vessels from 5-3,000 gal capacity, pipelines, valves, instruments, and drums, etc. —**Isopad, Ltd.**, Barnet By-Pass, Boreham Woods, Herts.

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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

Monday, 1st December

BIRMINGHAM. — College of Technology, Gosta Green, 6 p.m. I.E.E. South Midland Centre, Radio and Measurements Group, Supply and Utilisation Group and Birmingham Centre, I.P.O.E.E. "Standardisation of Control Facilities for the British Grid: Communications, Indications and Telemetering," by P. F. Gunning, and "The Development of Communication, Indication and Telemetering Equipment for the British Grid," by G. A. Burns, F. Fletcher, C. H. Chambers and P. F. Gunning.

BOLTON.—Railway Hotel, Trinity Street, 7.45 p.m. A.S.E.E. Bolton Branch. "Infra-Red Heating."

CHATHAM.—Medway College of Technology, 7 p.m. I.E.E. District meeting. "The Organisation for Large-Scale Grid System Tests," by Dr. F. H. Last, E. Mills and N. D. Norris.

HULL. — Yorkshire Electricity Board, Ferensway, 6.30 p.m. I.E.S. Leeds Centre. "Photo-electric Cells and their Applications," by F. A. Benson.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North East London Branch. "Affairs of the Association," by J. H. K. Pendry.

LEEDS.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "Modern Cable-making Methods."

LONDON.—At the I.E.E., Savoy Place, W.C.2, 6.30 p.m. A.S.E.E. London National Lecture. "Brains Trust." Discussion on Education, Training and Status of Electrical Technicians.

Caxton Hall, S.W.1, 7 p.m. E.P.E.A. London Technical Group. "British Fuel and Power Policy," by A. M. F. Palmer.

At the Geological Society, Burlington House, W.1, 5.30 p.m. Society of Engineers. "Some Industrial Applications of Magnetic Power," by T. J. Hawker.

NEWCASTLE-UPON-TYNE. — King's College, 6.15 p.m. I.E.E. North-Eastern Radio and Measurement Group. "An Experimental Approach to the Cooling of Transformer Coils by Natural Convection," by E. D. Taylor, B. Berger and B. E. Western.

County Hotel, 6.30 p.m. North East Electrical Club. "Circuit Protection," by J. A. Robbins.

Tuesday, 2nd December

BIRMINGHAM.—Town Hall, 7 p.m. I.E.E. South Midland Centre. Faraday Lecture on "Automation," by Dr. H. A. Thomas.

CHELTENHAM.—Rotunda, 7.30 p.m. Society of Instrument Technology, Cheltenham Section. "The Industrial Uses of Computers," by R. H. Tizard.

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "The Generation of Electricity in the London Area," by H. V. Pugh.

HAMMERSMITH. — Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "Progress in Electronic Switching in Telephone Exchanges," by N. C. Smart.

IGHTHAM.—George and Dragon, 7.30 p.m. A.S.E.E. West Kent Branch. Social evening.

LEEDS.—C.E.G.B. Offices, 6.30 p.m. I.E.E. North Midland Centre. "Operational Experience at Calder Hall," by K. L. Stretch.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Supply Sections. "Power-System Automatic Frequency Control Techniques," by F. Moran.

At the R.S.A., John Adam Street, Adelphi, Strand, W.C.2, 7 p.m. Incorporated Plant Engineers, London Section. "The Historical Development of Electric Traction," by E. Openshaw Taylor.

MANCHESTER.—Engineers' Club, 17, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "Thermonuclear Fusion and the Development of 'Zeta'," by E. R. Hartill.

STOKE-ON-TRENT.—North Stafford Hotel, 6 p.m. I.E.S. Stoke-on-Trent Group. "Brains Trust."

Wednesday, 3rd December

BIRMINGHAM.—James Watt Memorial Institute, Great Charles Street, 7 p.m. Junior Institution of Engineers, Midland Section. "Factory Heating and Ventilating," by J. F. Elsworth.

CHATHAM. — Medway College of Technology, 7 p.m. I.E.E. London Graduate and Student Section. District meeting. Film evening.

CHIPPENHAM.—At the Westinghouse Brake & Signal Co., 6.30 p.m. I.E.E. Bristol Graduate and Student Section. "Graphical Analysis Applied to Simple Rectifier Circuits," by C. F. Amor.

EDINBURGH.—14, South St. Andrew Street, 6.30 p.m. I.E.S. Edinburgh Centre. "Glassware for Lighting Fittings," by D. Shellshear and C. D. Cartwright.

HALIFAX.—Crown Hotel, Horton Street, 7.45 p.m. A.S.E.E. Halifax Branch. "Traffic Control and Road Safety," by Inspector Watson.

HOVE. — S.E.E.B. Offices, 10, Queen's Gardens, 6.30 p.m. I.E.E. Southern Centre. "The Television Studio as seen by the Producer," by A. Rakoff.

LONDON.—At the Institution of Mechanical Engineers, Birdcage Walk, S.W.1, 6 p.m. Institution of Heating and Ventilating Engineers. "Electrostatic Precipitation as Applied to the Heating and Ventilating Industry," by D. A. Bennell.

John Adam Street, Adelphi, W.C.2, 2.30 p.m. Royal Society of Arts. "The Consulting Engineer and his Contribution to the National Economy," by J. S. Tritton.

MANCHESTER. — A.S.E.E. Manchester Branch. 7 p.m. Chairman's night and hot pot supper.

MIDDLESBROUGH. — Cleveland Scientific and Technical Institute, Corporation Road, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. "Colour Television," by C. J. Stubbington.

NOTTINGHAM. — Mechanics' Institution, Trinity Square, 7.30 p.m. A.S.E.E. Nottingham Branch. "Switchgear Testing," by R. Jones.

PRESTON. — R.A.F.A. Club, East View, 7.30 p.m. A.S.E.E. Preston Branch. "Electrical Association for Women," by Mrs. H. E. Rhodes.

SOUTHSEA.—Royal Beach Hotel, 7.30 p.m. Incorporated Plant Engineers, Southern Section. "Safety in the Use of Electricity," by S. J. Emerson.

SWANSEA.—South Wales Electricity Board, The Kingsway, 6.30 p.m. I.E.S. Swansea Group. "Industrial Lighting Problems," by W. Imrie-Smith.

WOOD GREEN.—Town Hall, 7.45 p.m. A.S.E.E. North London Branch. "Electrical Water Treatment," by A. G. Freeborn.

Thursday, 4th December

CARDIFF.—South Wales Electricity Board, The Hayes, 6 p.m. I.E.S. Cardiff Centre. "Industrial Lighting Problems," by W. Imrie-Smith.

CHELMSFORD. — Crompton's Social Hall, 7.30 p.m. Chelmsford Engineering Society. "The Stage and the Engineer," by F. B. Bentham.

GLASGOW.—29, St. Vincent Place, 6.30 p.m. I.E.S. Glasgow Centre. "Glassware for Lighting Fittings," by D. Shellshear and C. D. Cartwright.

GRANGEMOUTH.—Leapark Hotel, 7 p.m. Society of Instrument Technology, Grangemouth Section. Annual general meeting.

HULL.—Yorkshire Electricity Board Offices, Ferensway, 6.30 p.m. I.E.E. North Midland Centre. District meeting. "Organisation for Large-Scale Grid System Tests," by Dr. F. H. Last, E. Mills and N. D. Norris.

LEEDS.—Hotel Metropole, 2.30 p.m. Combustion Engineering Association, Northern Region. "Utilisation of Low Grade Fuels."

LEICESTER.—De Montfort Hall, 7.15 p.m. I.E.E. East Midland Centre. Faraday Lecture on "Automation," by Dr. H. A. Thomas.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Ordinary meeting (in conjunction with the British Nuclear Energy Conference). "A Review of Work towards Nuclear Energy from Controlled Thermonuclear Reaction," by D. W. Fry.

MANCHESTER.—North Western Electricity Board, Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. "Recent Developments in Lighting Design Techniques," by H. E. Bellchambers.

College of Technology, Sackville Street, 6.30 p.m. British Institution of Radio Engineers, North Western Section. "High Input Impedance D.C. Amplifiers," by S. Stuart.

NOTTINGHAM.—Electricity Service Centre, 6 p.m. I.E.S. Nottingham Centre. "Lighting—and Other Things—in Moscow and Leningrad," by A. G. Penny.

SHEFFIELD. — Grand Hotel, 7.30 p.m. Incorporated Plant Engineers, Sheffield and District Section. Dinner and dance.

SOUTHAMPTON. — Pilgrim Room, Polygon Hotel, 8 p.m. A.S.E.E. Southampton Branch. Joint lecture with Electrical Association for Women.

Friday, 5th December

BIRMINGHAM.—At the Warwickshire County Cricket Club, Edgbaston. Institution of Heating and Ventilating Engineers, Birmingham District. Annual dinner.

BRISTOL.—Grand Hotel, 8 p.m. A.S.E.E. Bristol and West of England Branch. Lecture and film, "Capacitors Pay Dividends."

CARDIFF.—Royal Hotel. Institution of Heating and Ventilating Engineers, South Western Branch. Annual dinner.

CHELTENHAM. — Plough Hotel. Plastics Institute, Western Section. Annual dinner-dance.

FAWLEY.—Copthorne House. Society of Instrument Technology, Fawley Section. "Electrical Weighing, Its Techniques and Application," by K. J. Railler.

LIVERPOOL. — M.A.N.W.E.B., Paradise Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. "Flameproof Installations," by W. T. Partington.

LONDON.—14, Rochester Row, 7 p.m. Junior Institution of Engineers. Film evening.

MANCHESTER.—Grand Hotel. Incorporated Plant Engineers, Manchester Section. Annual dinner.

PORTSMOUTH. — College of Technology, 7 p.m. Institution of Electronics, Southern Division. "The Applications of Transistors in Communications and Control Equipment," by E. Wolfendale.

Saturday, 6th December

LONDON.—Park Lane Hotel, W, 6 for 6.30 p.m. A.S.E.E. Ladies' night.

PORTHCAWL.—Seabank Hotel. Incorporated Plant Engineers, South Wales Section. Ladies' night, dinner-dance.

St. Dunstan's

The annual report of St. Dunstan's contains details of the valuable work which the Institution has done for the blind during the year 1957-58. It is profusely illustrated and includes a message from Lord Fraser, its president. Thanks are expressed to all those who by donations, service and other support have enabled the Institution to carry on its great work.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Director, Stores and Contracts, Postmaster-General's Department, Melbourne. 18th December. Telephone jacks and number plates. (E.S.B. 27801/58. Ten/35813.)* 15th January. Copper resistance wire. (E.S.B. 28057/58. Ten/35805.)* 20th January. Induction coils. (E.S.B. 28346/58. Ten/35898.)* Telephone parts. (E.S.B. 28347/58. Ten/35897.)*

State Electricity Commission of Queensland, Brisbane. 25th February. Two 30,000 kW water driven turbo-alternator sets for Barron Gorge power station. (E.S.B. 28676/58. Ten/35899.)*

Belfast.—Northern Ireland Ministry of Finance. 11th December. Electric lamps at Government establishments in Northern Ireland during the year ending 31st January, 1960.

Belgium.—Antwerp Port Administration Technical Service. 4th December. Cables, cable boxes and accessories. (E.S.B. 19573/58. Ten/35902.)*

Burma.—Director of Civil Aviation, Rangoon. 15th January. Teleprinters, v.h.f. transmitters, etc. (E.S.B. 27989/58/I.C.A. Ten/35850.)*

Canada.—Saskatchewan Power Corporation, Regina. 8th December. Electrical materials, including insulators, switches, aluminium tape and cable, wire, capacitors, street lighting fittings, meters, lamps, transformers ranging from 3 kVA to 75 kVA, etc. (E.S.B. 27961/58. Ten/35860.)*

Cavan.—County Council. 11th December. Two electrically driven pumps. (E.S.B. 28397/58. Ten/35847.)*

Ceylon.—Tender Board, Ministry of Posts, Broadcasting and Information, Colombo. 13th January. Radio receiving sets and spares. (E.S.B. 28630/58. Ten/35894.)*

Douglas (I. of M.).—Noble's Isle Hospital Management Committee. Registered electrical contractors are invited to submit their names for work in connection with a central heating station and multi-purpose ward block and operating theatre unit. (See this issue.)

Formosa.—Central Trust of China, Taipei. 8th December. 800 A, 66 kV line taps and 1,200 A, 154 kV line taps. (E.S.B. 27680/58/I.C.A. Ten/35810)* 12th December. Automatic voltage regulators. (E.S.B. 28412/58/I.C.A. Ten/35877.)* 15th December. Telephone ringing equipment. (E.S.B. 28411/58/I.C.A. Ten/35908.)*

India.—Neyveli Lignite Corporation (Private), Ltd. 10th December. Oil circuit-breakers and battery charger units. (E.S.B. 29074/58. Ten/35972.)*

Korea.—Government Office of Supply, Seoul. 12th December. Transformers, circuit-breakers, lightning arrestor and disconnecting switches. (E.S.B. 27970/58/I.C.A. Ten/35817.)*

Luton. — Corporation. Street lighting columns. (See this issue.)

New Zealand.—G.P.O., Wellington. 12th December. Coaxial resonator type filters. (E.S.B. 28155/58. Ten/35812.)* 17th December. Glass cartridge fuses and holders. (E.S.B. 28443/58. Ten/35841.)*

New Zealand Electricity Department, Wellington. 27th January. Two 30,000 kVA synchronous condensers. (E.S.B. 28315/58. Ten/35820.)*

Peterlee.—Peterlee Development Corporation. 6th December. Electrical installations in 218 dwellings in the South West area. A. Williams, general manager, Shotton Hall, Old Shotton, Peterlee, Horden.

Rhodesia and Nyasaland.—Salisbury City Council. 2nd December. Radio telephone equipment. (E.S.B. 28448/58. Ten/35868.)*

Federal Tender Board, Causeway. 5th December. Physiotherapy equipment. (E.S.B. 28197/58. Ten/35848.)*

South Africa.—Stores Department, South African Railways, Johannesburg. 5th December. Overhead track equipment. (E.S.B. 28837/58. Ten/35940.)* 10th December. Insulated cable. (E.S.B. 28897/58. Ten/35943.)* Eleven 5 kVA transformers. (E.S.B. 28898/58. Ten/35942.)*

Thailand.—Thai Sugar Corporation. 4th December. One 100 kW diesel generating set. (E.S.B. 28107/58. Ten/35808.)*

United States.—Bonneville Power Administration, Portland, Oregon. 5th December. Three 83,333 kVA, one 30,000 kVA, and one 200,000 kVA auto-transformers, and one 40,000 kVA power transformer. (E.S.B. 28452/58. Ten/35870.)*

Willesden.—Corporation. 19th December. Street lighting equipment. (See this issue.)

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Adwick-le-Street.—Bungalows (36), Carcroft and Skellow; W. S. Ellis, surveyor, Council Offices, Adwick-le-Street, Yorks.

Bournemouth.—Reconstruction of Savoy Theatre premises, Boscombe, to form self-service store; Fine Fare, Ltd., Kingsland Crescent, Poole.

Bristol.—Oil storage terminal for Esso Petroleum Co., Ltd., Holesmouth; A. E. Farr, Ltd., contractors, Station Road, Westbury, Wilts.

Chester.—Dwellings (123), Newton Hall estate; city surveyor.

Chesterfield.—Fire Service workshops, Whittington Moor (£50,000); county architect, Matlock.

Depwade.—Council offices at Long Stratton (£30,000); D. Chilver, surveyor, Rural Council Offices, Pulham Market, Diss.

Dorchester.—Reconstruction of constabulary headquarters and divisional headquarters (£54,000); county architect, County Hall, Dorchester.

Exmouth.—Major extensions to Council offices; surveyor, Urban Council Offices.

Glasgow.—Proposed large development, Argyle Street/Union Street site; Boots Chemists, Shandwick Place, Edinburgh.

Second stage of development, Gorbals/Hutchestontown area; Architects' Department, Municipal Buildings, George Square.

Harrow.—Supermarket, Coliseum site, High Street; Express Supermarkets, Ltd., 15, Tavistock Place, London, W.C.1.

Hatfield.—Church of St. John, with community centre; Abbiss & Hale, Ltd., builders, Mill End, Rickmansworth.

Jarrow.—Houses (30-40), Monkton; Wilkinson Brothers, builders, Pillars Yard, High Street, Gateshead.

Leamington Spa.—Eleven-storey block of flats, New Brook Street; Unity Structures, Ltd., 15, Cromer Street, London, W.C.1.

Leicester.—Alterations to departmental store (£30,000); Morgan Squire, Ltd., Hotel Street.

Liverpool.—Omnibus and coach station, Skelhorne Street; Tysons, Ltd., contractors, Dryden Street.

Llanelly.—Factory and offices; Crawley Industrial Products, Ltd., 48, Wellesley Road, Croydon.

London.—Factory and offices, Chiswick; W.V.G. Engineering Co., Ltd., 329, High Street, Brentford.

Extensions to St. Mary's Hospital Medical School, Paddington; Sir Edwin Cooper, R.A. & Partners, architects, 4, Verulam Buildings, W.C.1.

Office and showroom block, Tottenham Court Road; Ford & Walton, Ltd., builders, Walton House, Warton Road, E.15.

Loughborough.—Erection of Thorpe Acre School (£42,350); Leicestershire county architect, 123, London Road, Leicester.

Maidstone.—Additional factory premises; Albert E. Reed & Co., Ltd., Tovil Hill.

Flats (48), Park Wood estate; Herbert Richardson & Son, Ltd., builders, Slades Green Road, Crayford.

Newcastle-on-Tyne.—Halls of residence, Tankerville Terrace, for Council of King's College; J. H. Napper & Partners, architects, 56, Eldon Place, Newcastle.

Factory extension, City Road, for Thomas Hedley & Co., Ltd.; own architects.

Northants.—Secondary modern schools to be erected at Corby and Irthlingborough; county architect, County Offices, Guildhall Road, Northampton.

Norwich.—Studios for Anglia Television, 27, Soho Square, London, W.1; R. G. Carter, Ltd., builders, Drayton.

Peterborough.—Houses (34), Gunthorpe West estate; H. J. Firman, Ltd., Newark Road.

Pontypool.—Secondary modern school at Griffithstown (£105,865); county architect, Queen's Hill, Newport, Mon.

Richmond (Surrey).—Supermarket at 45-46, George Street for J. Sainsbury; Bovis, Ltd., builders, 1, Stanhope Gate, W.1.

South Shields.—Proposed secondary school at Simonside; J. Smeds, architect, 56a, Camden Street, North Shields.

Additions to Corporation transport depot (£38,000); Tarslag, Ltd., builders, Bowesfield Lane, Stockton.

Houses (91), Lizard Lane: John Reid, borough engineer.

Hotel, Lawe Road, for the Merchant Navy Welfare Board; Kitching & Co., architects, 21, Albert Road, Middlesbrough.

Four-storey furniture shops, Ocean Road, for Cromwells (Furnishers), Ltd., 26, Ocean Road, South Shields.

Sunderland.—Occupational centre and offices for the Corporation Mental Welfare Department (£23,000); borough architect.

Houses (84), Azalea Terrace; L. W. Evans & Co., builders, Norfolk Street.

Temple Cloud-Clutton.—Conversion of Cholwell House into Council offices; R. Burdge, clerk to R.D.C., Council Offices, Temple Cloud, nr. Bristol.

Wolverhampton.—St. Anthony's R.C. Primary School (£46,000); J. Brock Allon, town clerk, Town Hall.

Worcestershire.—Second instalment of Kidderminster College of Further Education; R. Y. Logan, director of education, Castle Street, Worcester.

Worsborough.—Aged persons' home, Elm House estate (£43,385); West Riding county architect, Westfield Road, Wakefield.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

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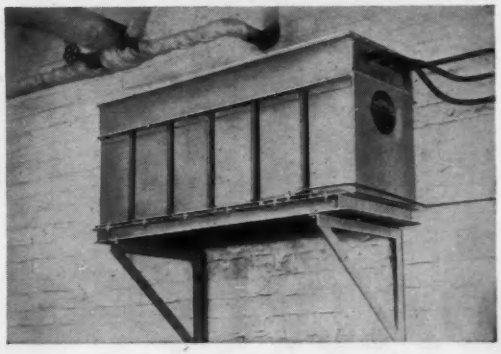

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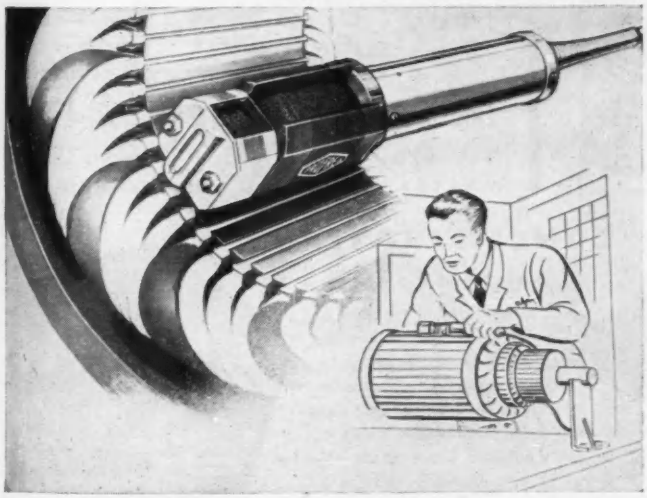

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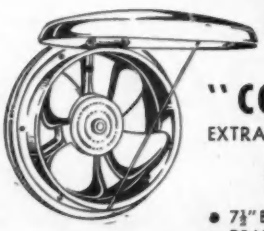

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FACTORS GOVERNING ELEMENT TEMPERATURE Element temperature depends on two factors (1) the surface area electrical loading (usually expressed as watts per sq. in. of resistor surface area) and (2) local heat dissipating conditions. While the first can be determined accurately for any piece of equipment, the second is subject to many influences such as type of mounting, dimensions of spiral, circulation of air around the element. It cannot easily be determined exactly. The rate at which heat can be dissipated or removed from the element governs the surface area electrical loading that can be allowed. Thus certain types of water heaters and space heaters using a forced draught may be loaded to a high watts density, while an enclosed oven element may have a low watts density.

TESTING ELEMENT MATERIALS As a basis for determining desirable element temperatures, and hence suitable electrical loading, a wire of the material to be tested is held horizontally in free air and used as a datum during the test. The result of this test is known as the ' straight wire free air temperature'. Equivalent temperatures have been worked out to enable data based on this temperature to be related to many types of element.

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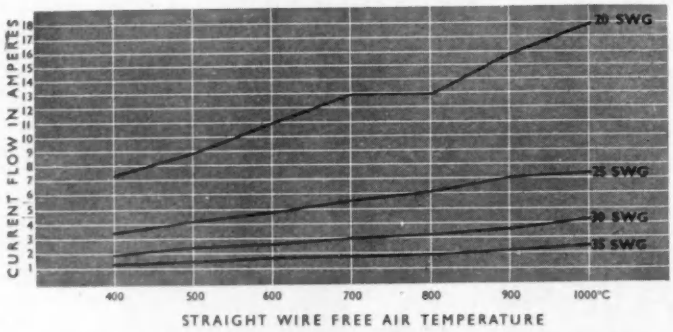

Graph showing Straight Wire Free Air Temperature/Current Flow for Brightray C

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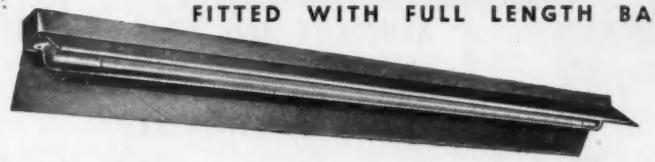

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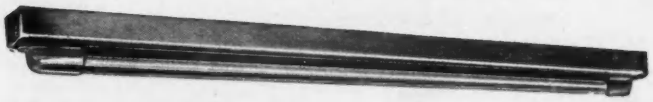

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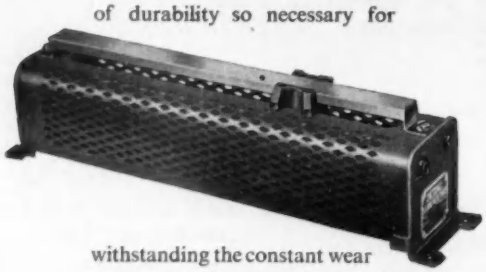

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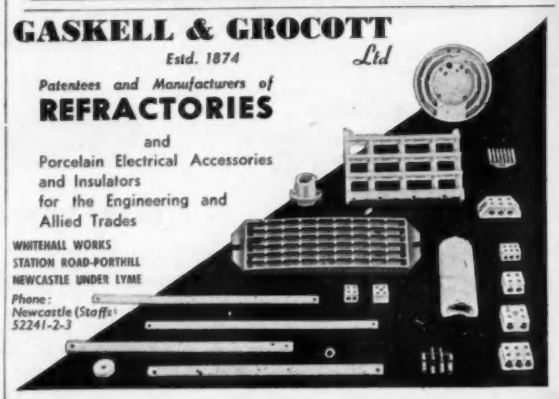

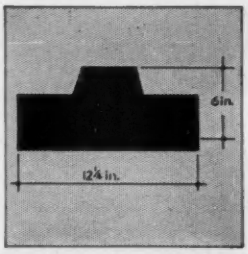

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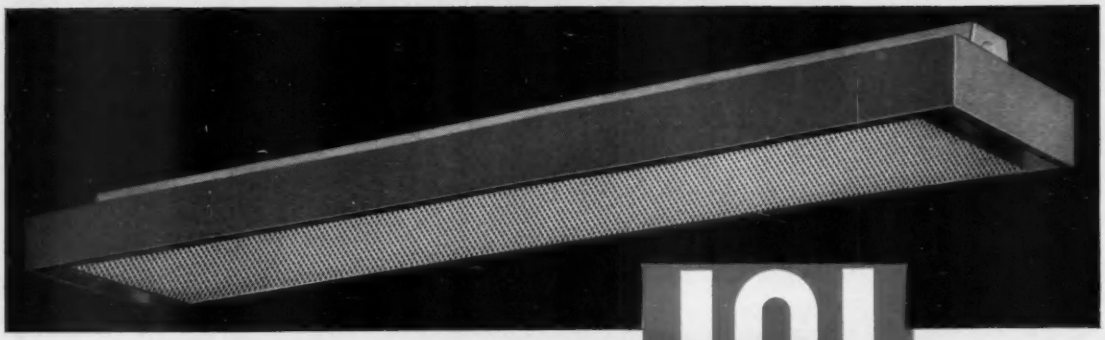

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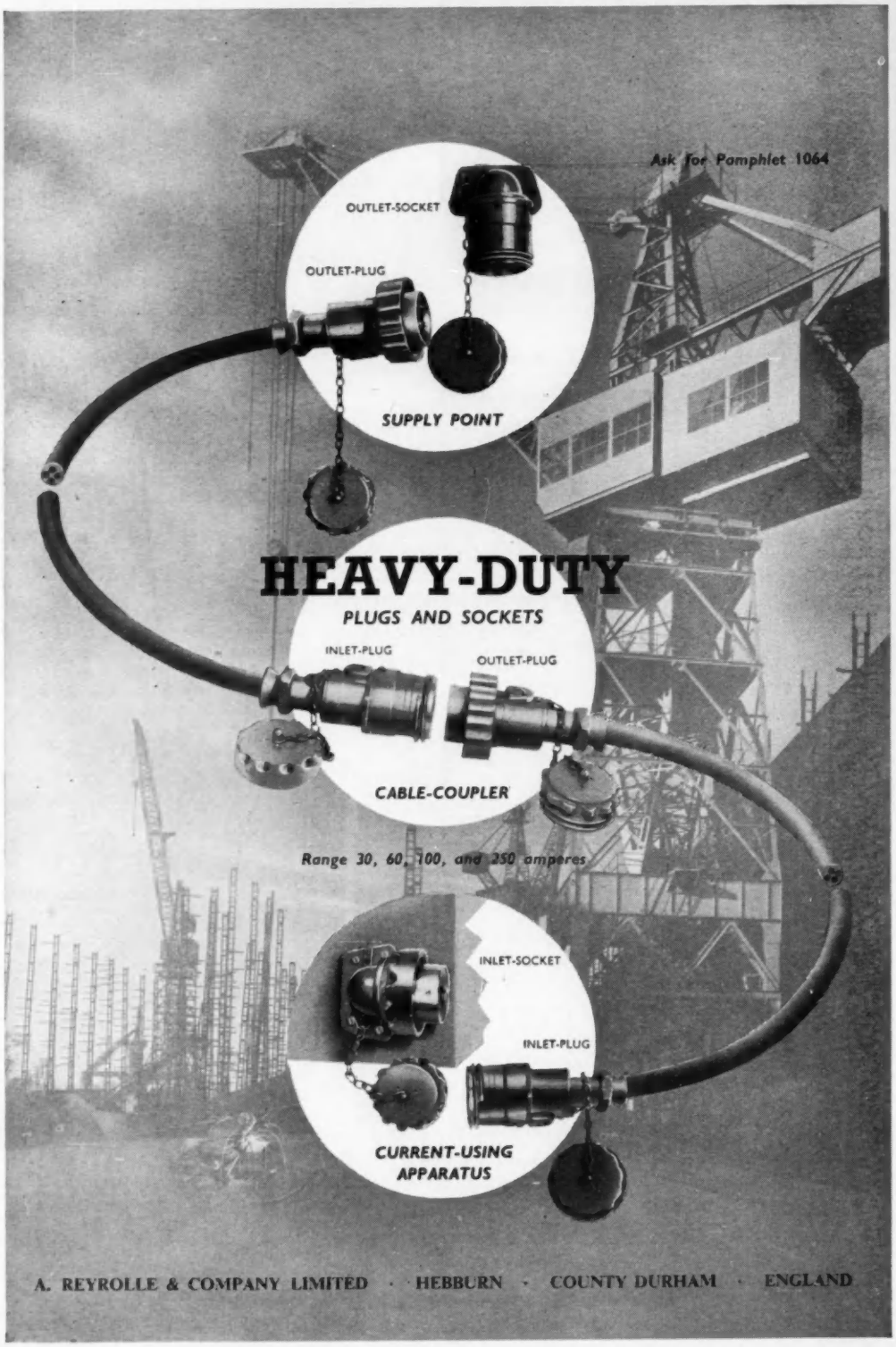
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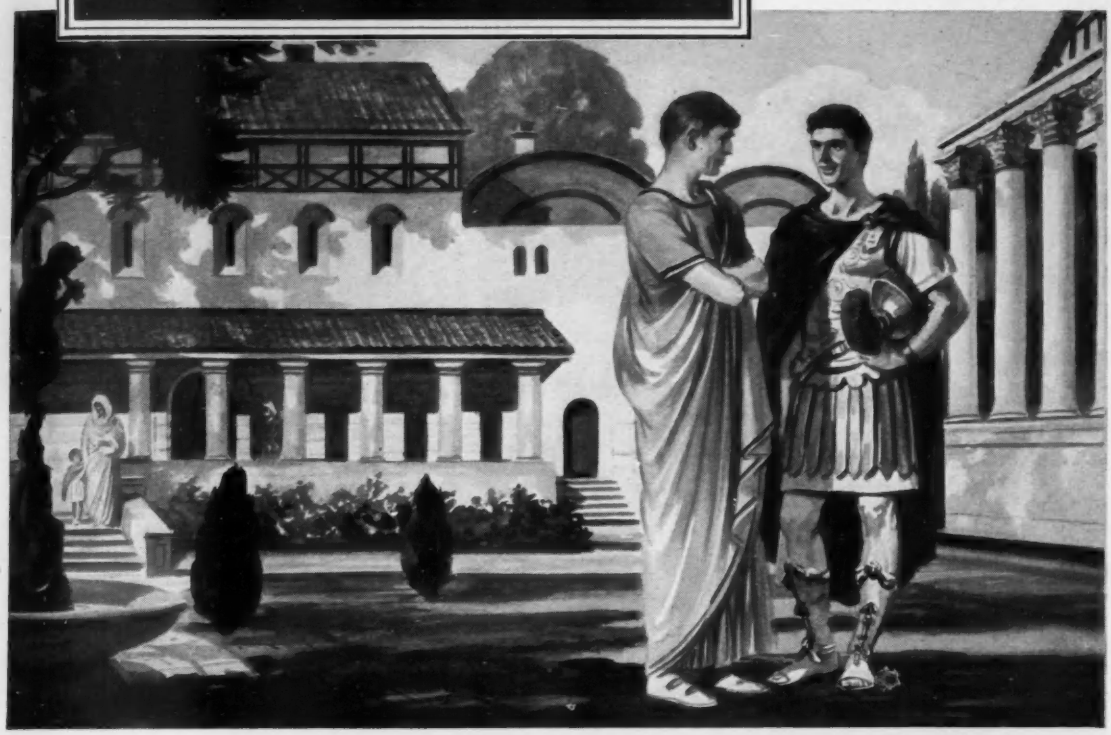

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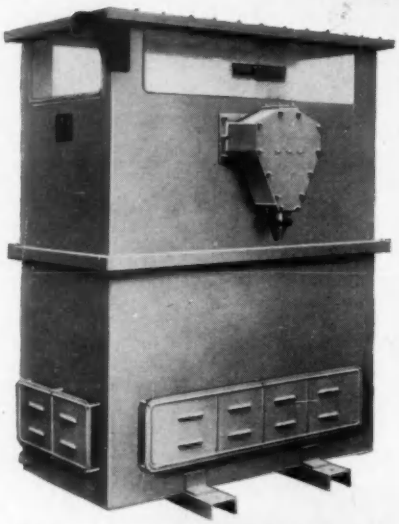

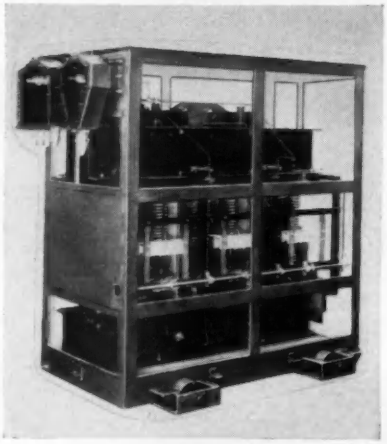

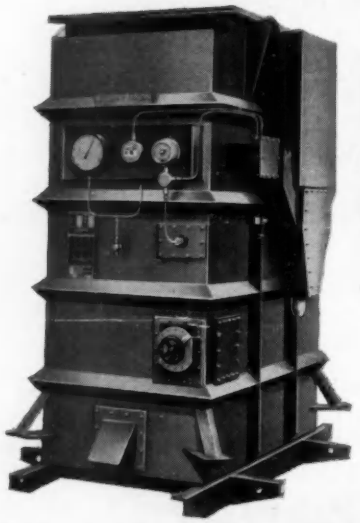

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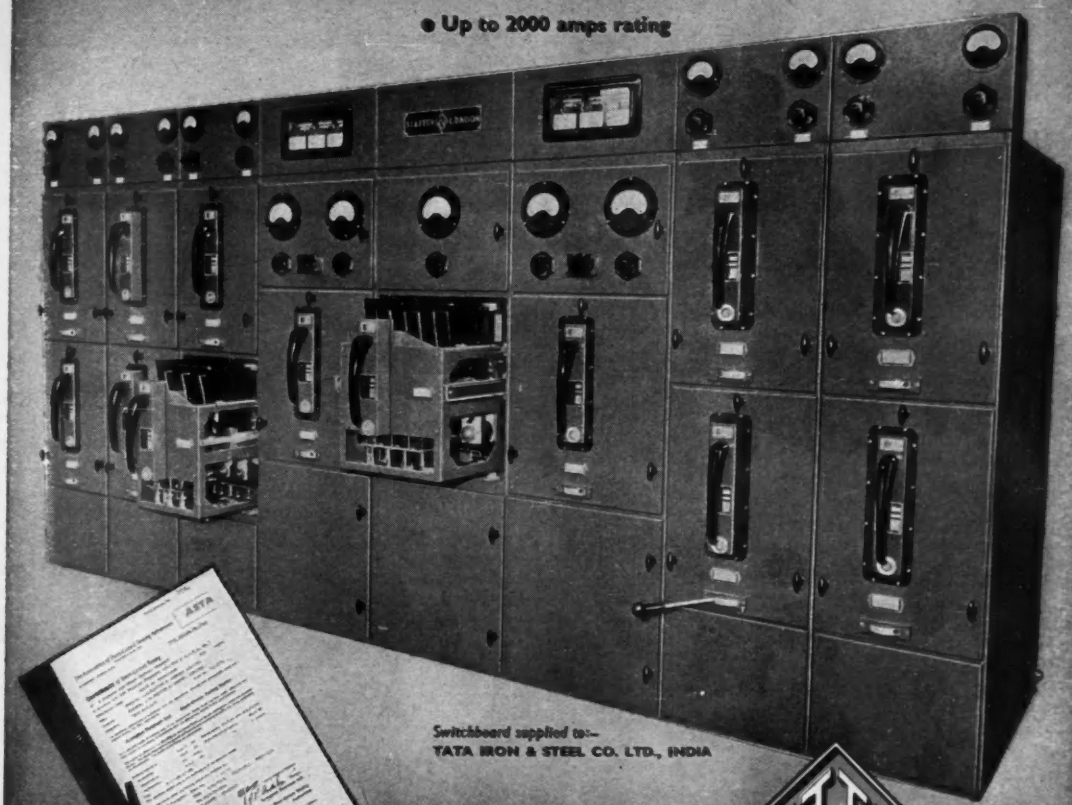

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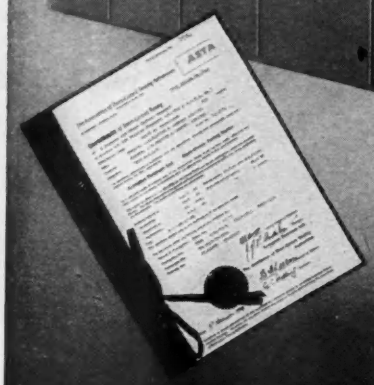

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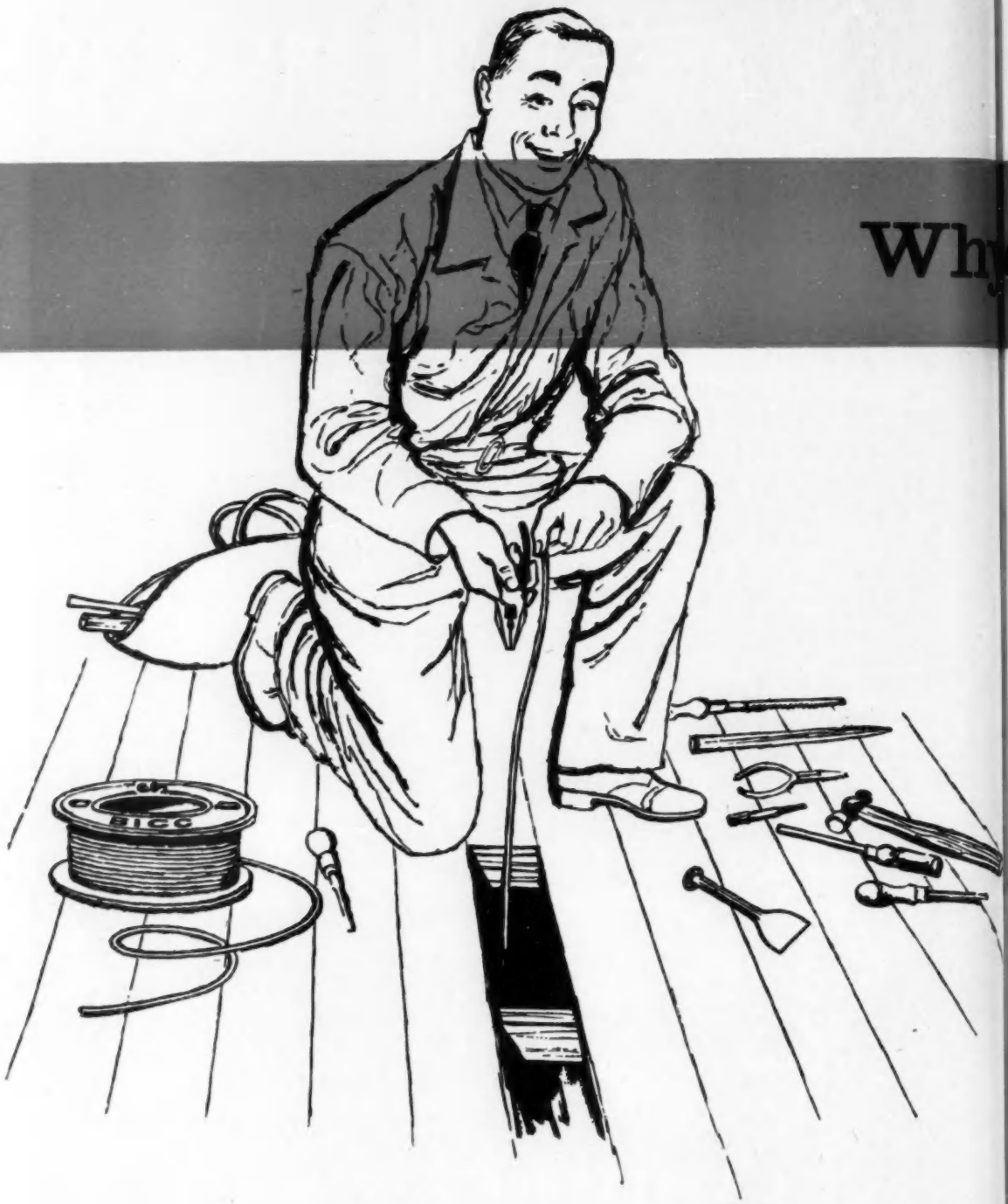

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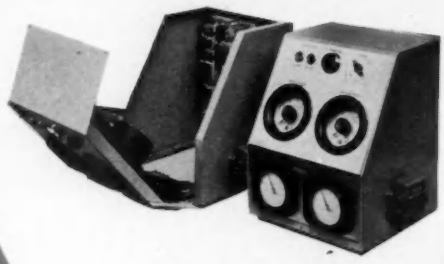

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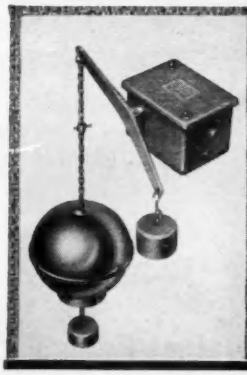

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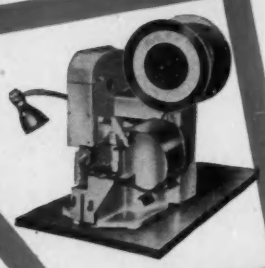

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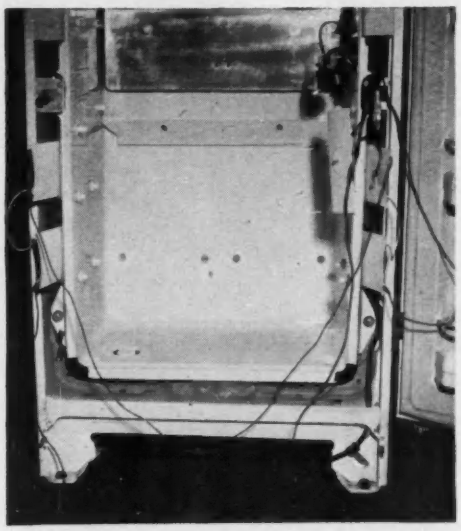
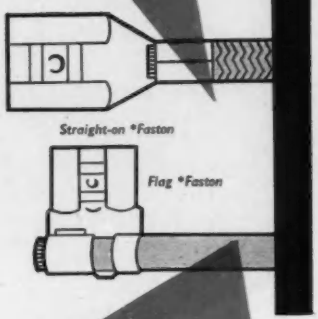


The illustration shows refrigerator harness employing *"Fastons" for quick and easy assembly.



Straight-on *Faston

Flag *Faston

Refrigerator photograph by courtesy of the "Prestcold" Division of the Pressed Steel Company Limited.

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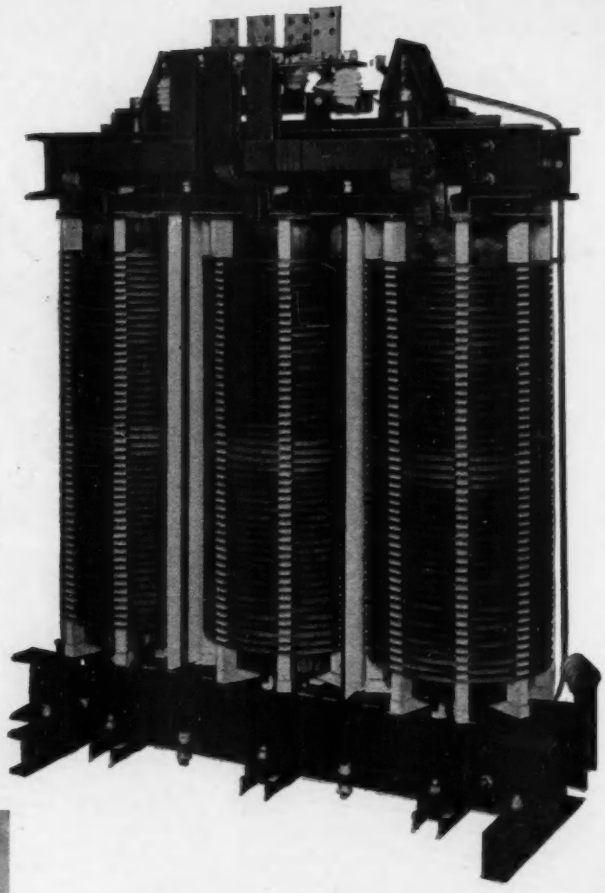

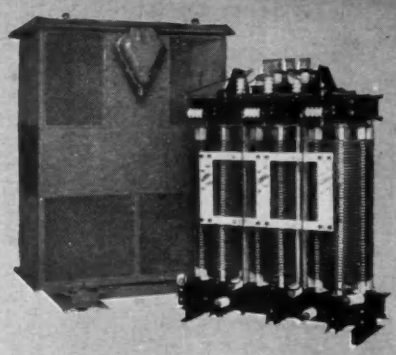

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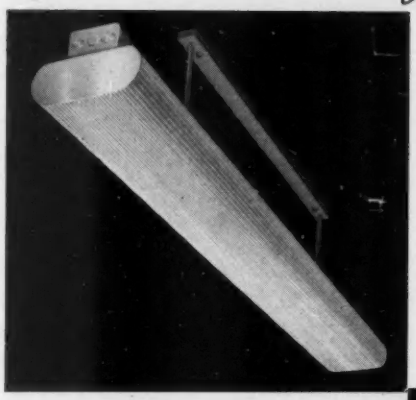

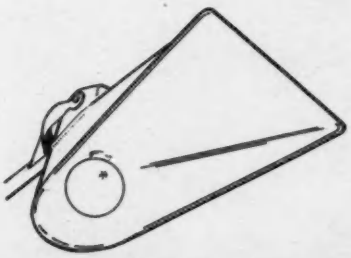

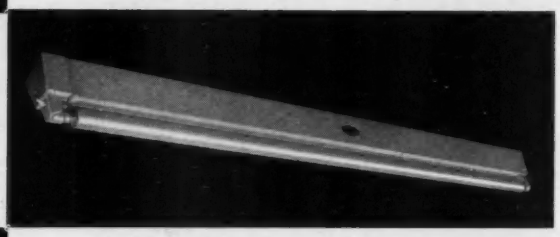

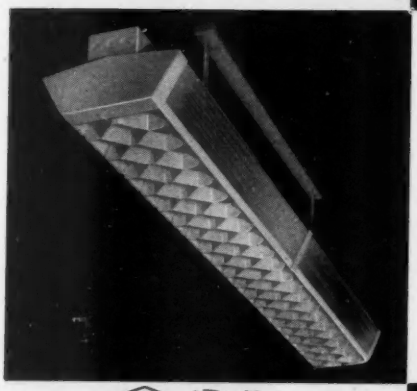

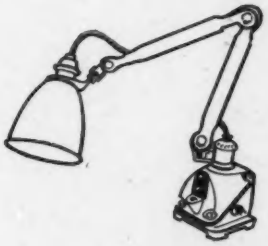

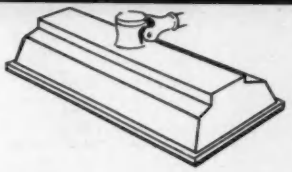

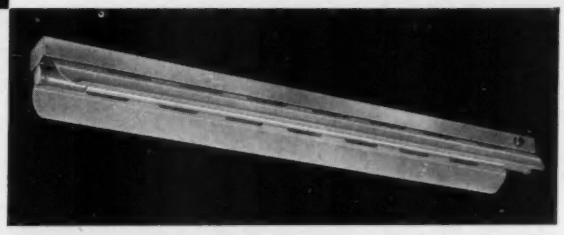

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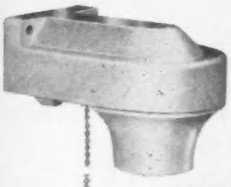

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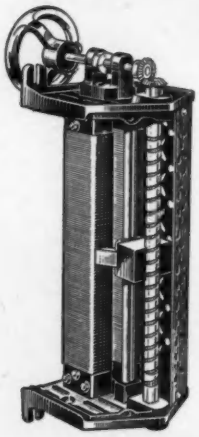

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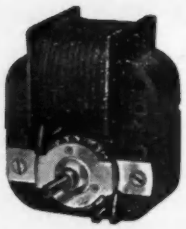

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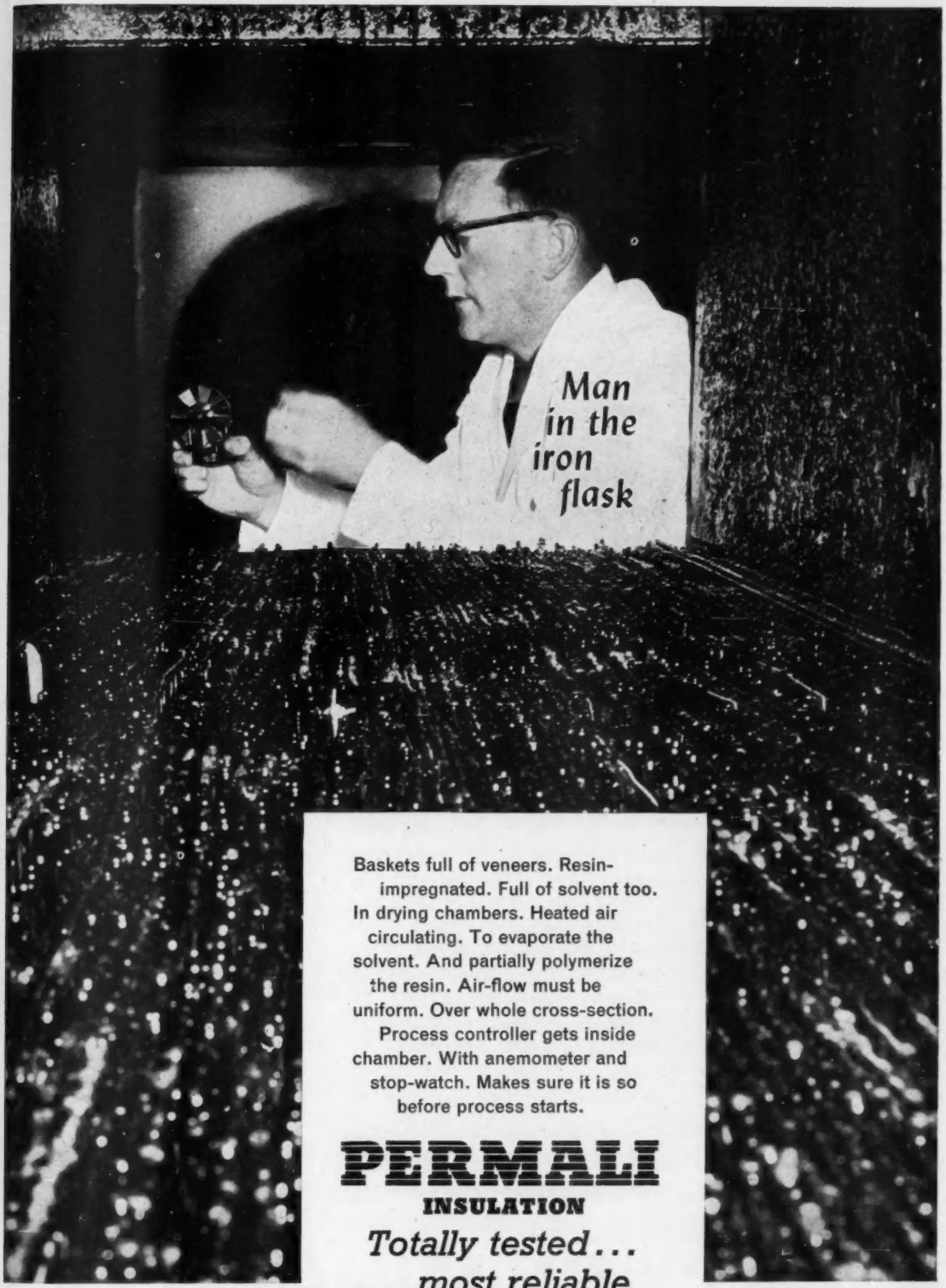

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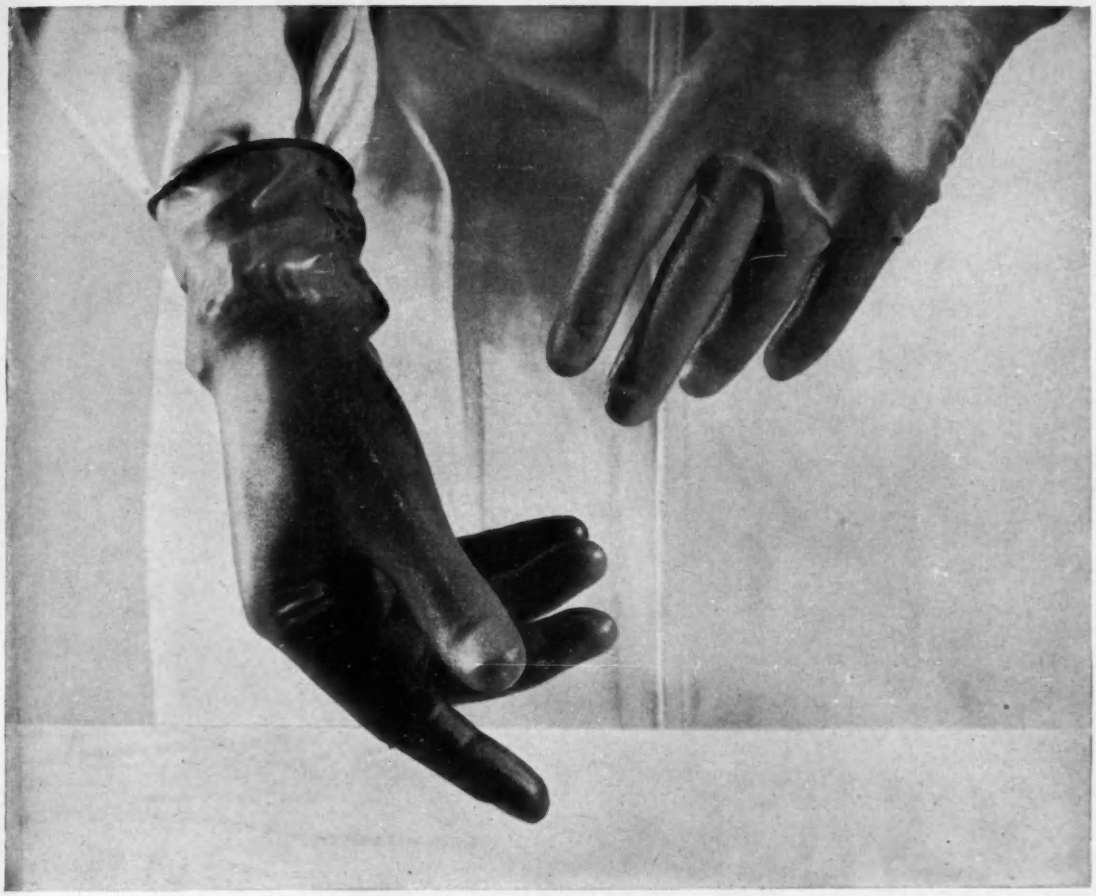

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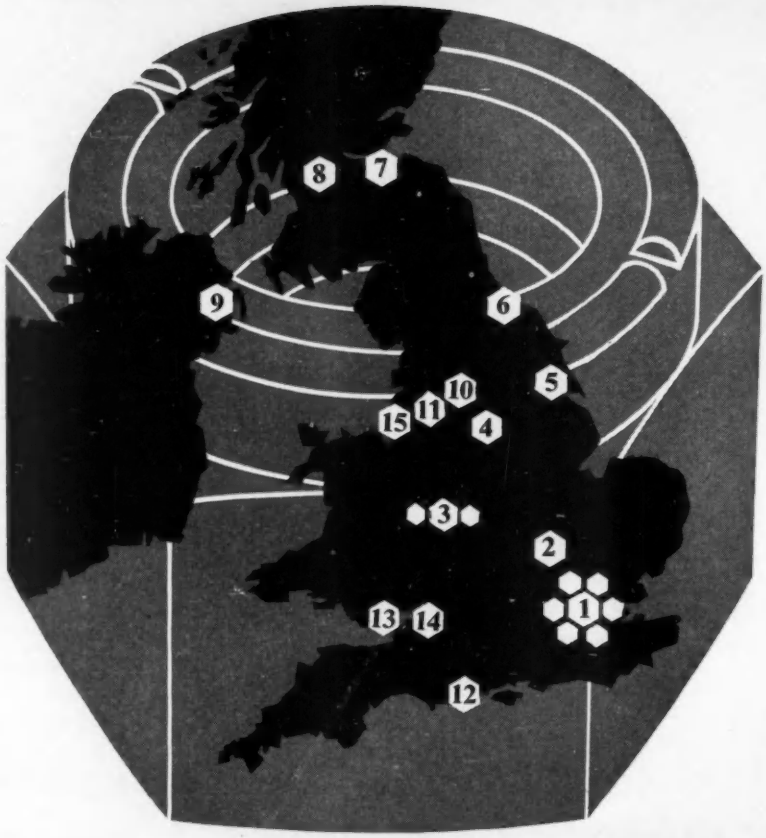

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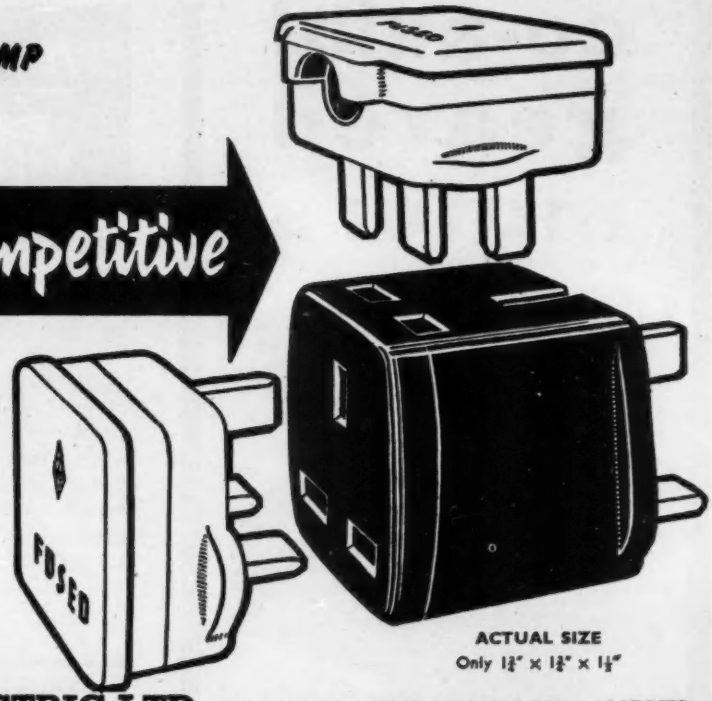

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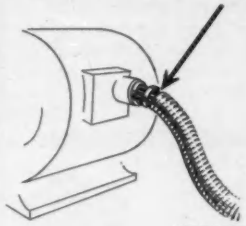

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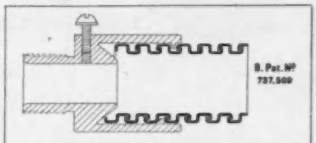

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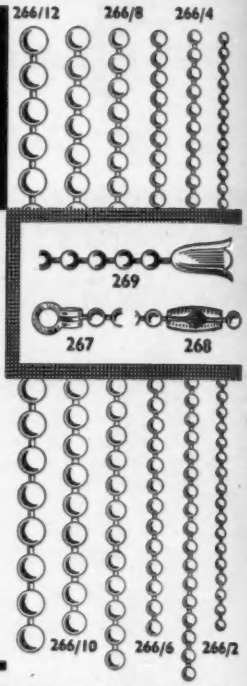

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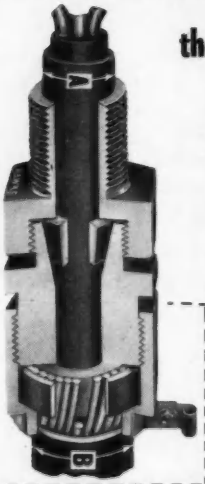

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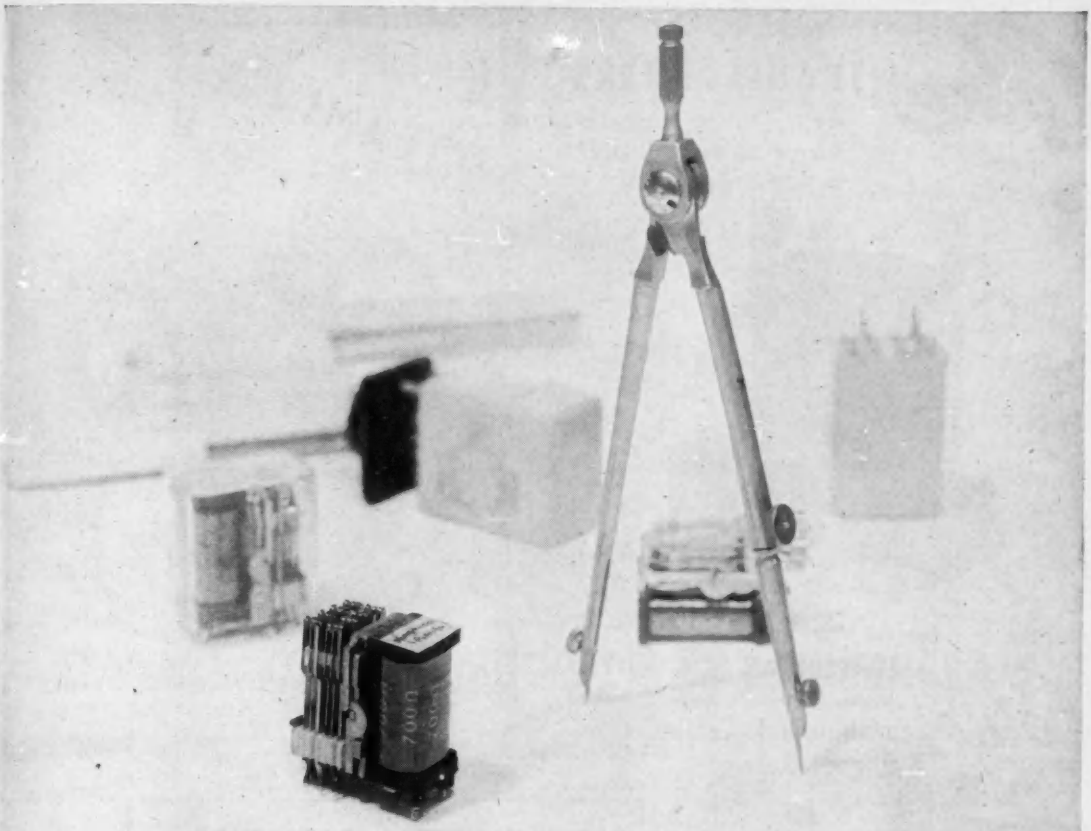

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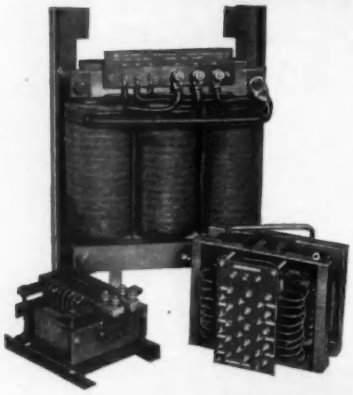

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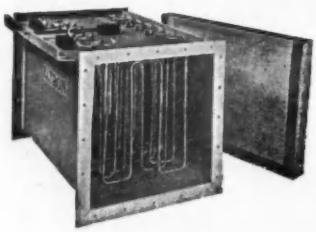

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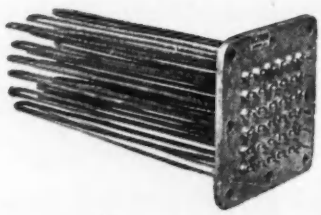

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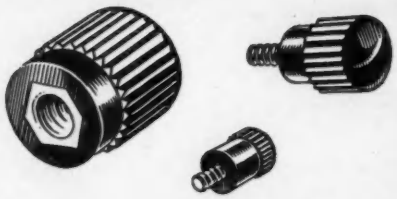

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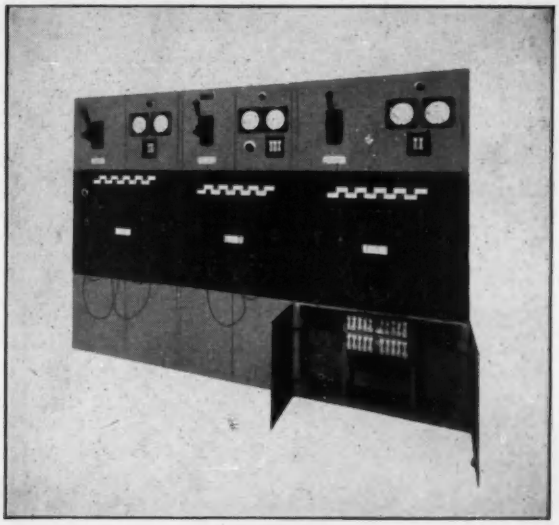

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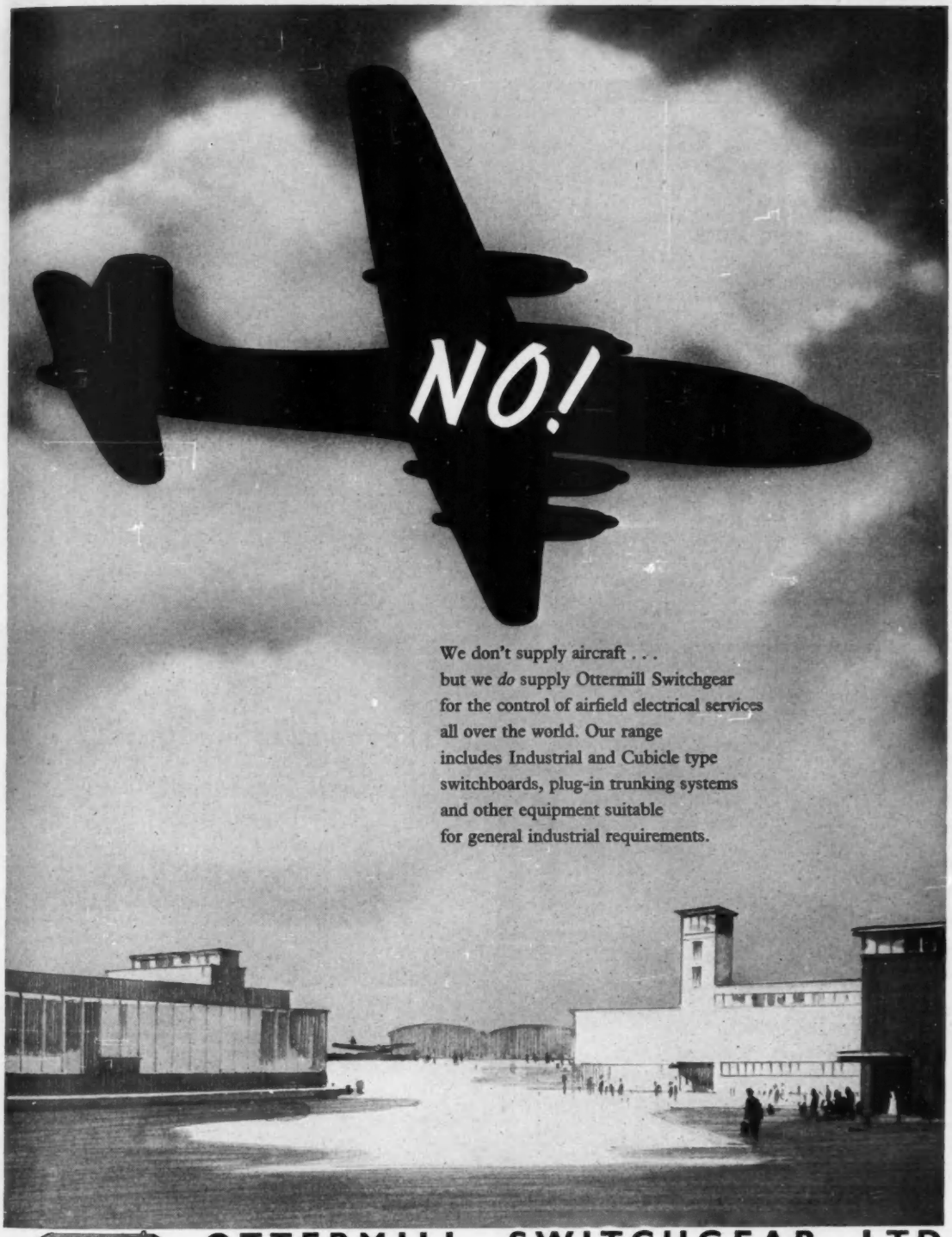

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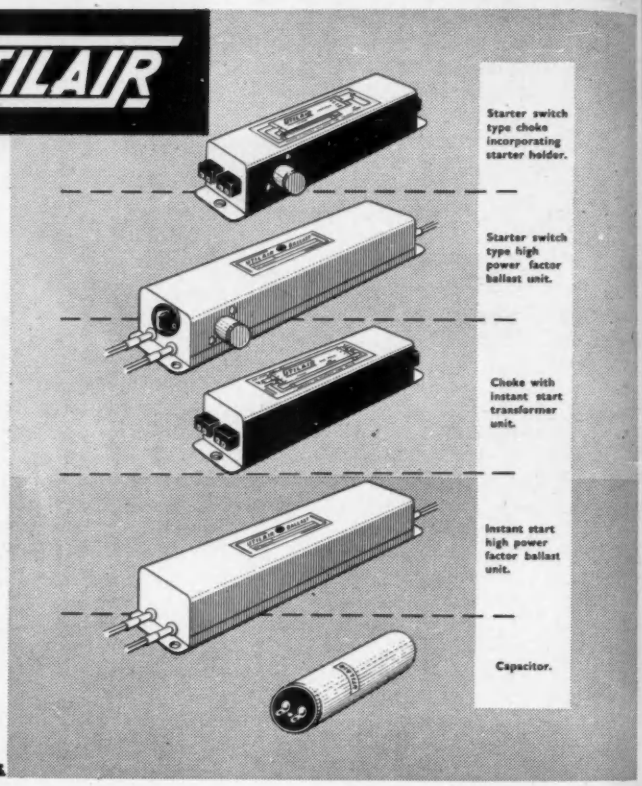
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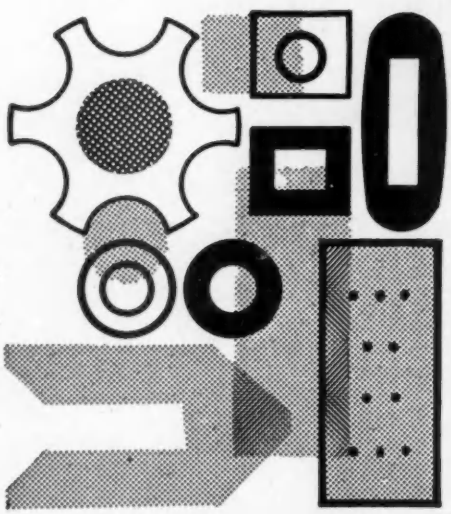

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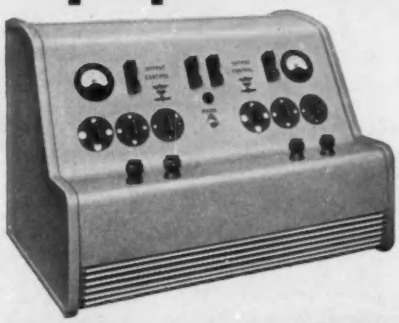

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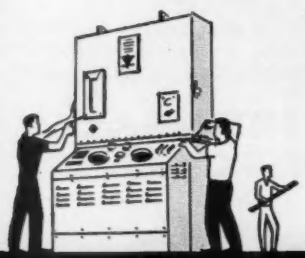

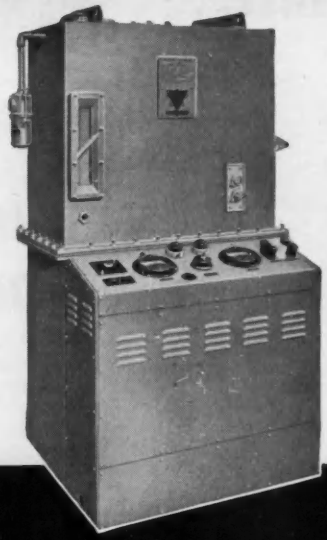

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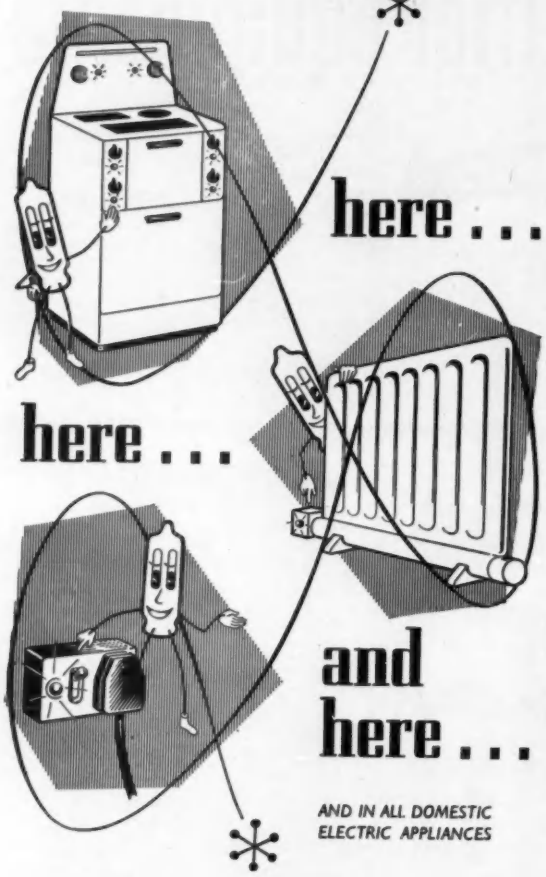

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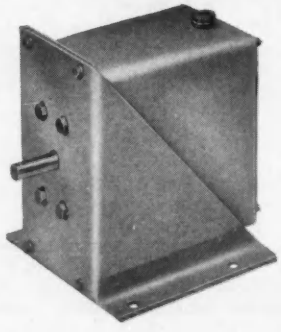

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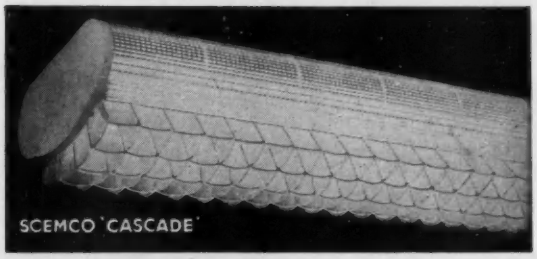

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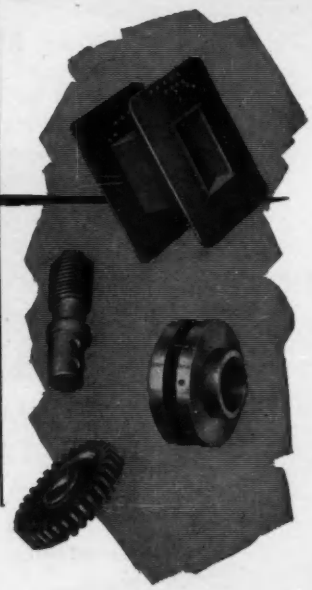

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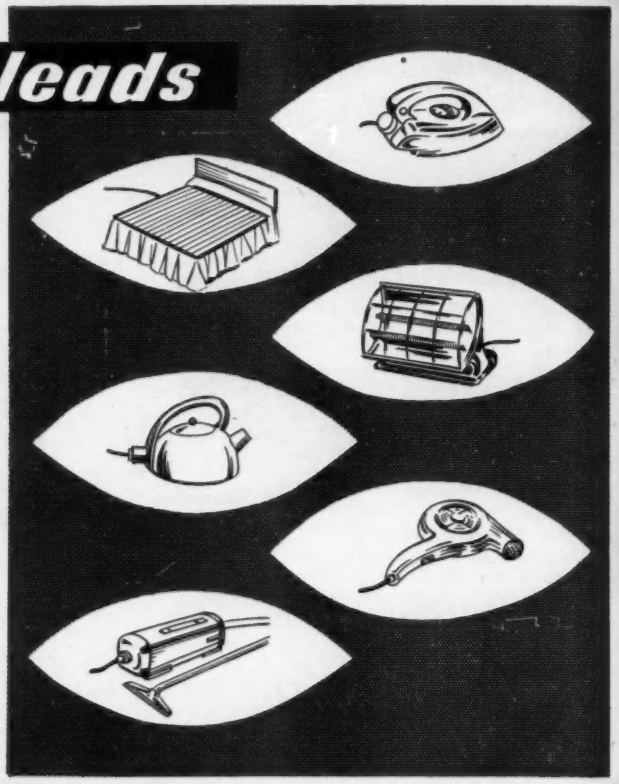

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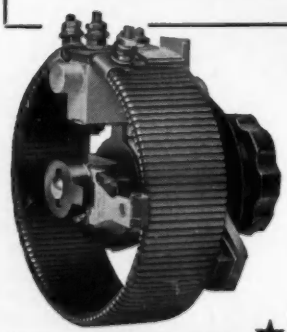

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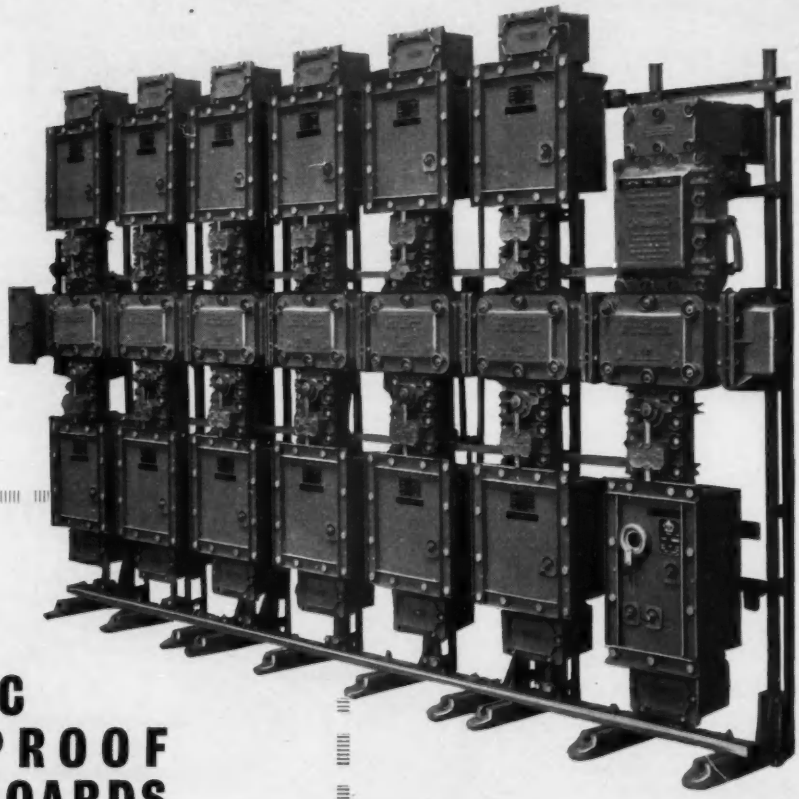

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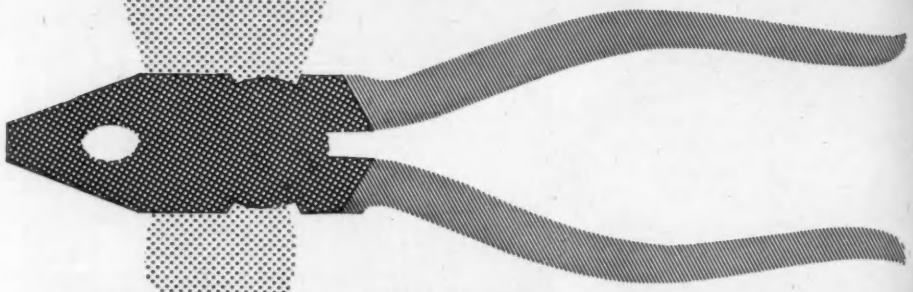

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GALLIERS
32 St. James's Street, Brighton
Telephone: Brighton 23201-2-3
Farm and Dairy Electrical Equipment

Electrical, Refrigeration and Radio Engineers. Installation Contractors. Lifts. Television
H. BENEY & SONS LTD.
99 South Street, Eastbourne
Telephones 4820/1 (Day and Night)

For first-class A.C. and D.C. Rewinds and Industrial Plant Maintenance
ELECTRICAL POWER REPAIRS (Gillingham) LTD.
Strover Street, Gillingham, Kent
Telephone: Gill. 5200 & 59356 (Day and Night)

Heavy Engineering and Electrical Contracting
DRAKE & FLETCHER LTD.
Maidstone, Kent
Telephone 2284
Refrigeration. Oil Heating and Drying Installations

F. W. BLANSHARD LTD.
23 Lansdowne Road, Purley, Surrey
Telephone: Uplands 4818, 4819 & 4810
Complete electrical installations. Rewinding and repair of motors and transformers. Manufacturers of control gear for fluorescent.

SOUTHERN

GOATER & MEDWAY LTD.
Electrical Engineers
121 Commercial Road, Southampton
Telephone 21440
Cable Jointing. Cable Laying. By Direct Contract and to the Trade.

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
32 Brassey Road, Winton, Bournemouth
Telephone: Winton 1609

. . . for all electrical installations
F. H. WHEELER (Southern) LTD.
Clifton Hall, Oakley Road, Shirley, Southampton
Telephone 73867

SOUTH WESTERN

. . . for all electrical installations
F. H. WHEELER (Bristol) LTD.
55 Queen Charlotte Street, Bristol 1
Telephone 26907

CLARKE BROS. (Stroud) LTD.
Bath Road, Stroud
Telephone: Stroud 1132/3
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

EASTERN

Norwich.....Cambridge.....Gt. Yarmouth.....Lowestoft.....Ipswich
EASTERN & HOME COUNTIES ELECTRICAL CONTRACTORS
Specialists in Large Scale Electrical Installation Contracts.
Electra House, Southtown Road, Gt. Yarmouth
Telephone: Gt. Yarm. 2390

EAST MIDLANDS

Electrical Engineers and Contractors
C. A. J. BILLINGTON LTD.
Cranfield, Bedfordshire
Telephone: Cranfield 293
Industrial Installation throughout the Home Counties

(Continued on page 110)

(Continued from page 109)

MIDLANDS

WALKER BROS. (ELECTRICAL ENGINEERS) LTD.
Quality House, Temple Row, Birmingham 2
Telephone: CEN. 7611/5
Electrical Installation Engineers. Industrial Installation Specialists
Established 1895

HARRIS & SHELDON LTD.
31 Stafford Street, Birmingham 4
Telephone: Central 7101
For all electrical contracting installations, lighting, heating, power, public address, etc.

Electrical and Mechanical Engineers, Factors
THE BIRMINGHAM POWER TRANSMISSIONS LTD.
117/118 Snow Hill, Birmingham 4
Telephone: AST. 2088-9

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
553 Moseley Road, Birmingham 12
Telephone: Calthorpe 2601-2

DYNAMO & MOTOR REPAIRS LTD.
Belgrave Terrace, Soho Road, Birmingham 21
Telephone: Northern 0098
Motor and generator repairs and rewinds. Installations and factory maintenance. Electrical plant stockists

For Electrical Installations of Quality consult:
HAROLD F. WARD LIMITED
Birmingham 28
Telephone: VIC 4041 (5 lines)

ELECTRICAL INSTALLATIONS LTD.
Faraday Works, Stoney Stanton Road, Coventry
Telephone 2970
Industrial Electrical Work of All Kinds. Over 40 Years' Experience

G. G. WALKER & CO. (Dudley) LTD.
31 Hall Street, Dudley
Telephone 4474/5
Rewinds, Lighting, Power, Electric Furnace, Electronic Installations and Maintenance, Television and Radio. Est. 40 years. E.C.A. Members

SOUTH WALES

CLARKE BROS. (Stroud) LTD.
Green Park Street, Aberavon
Telephone: Port Talbot 791
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

DRAKE & GORHAM (Contractors) LTD.
13 St. Andrew's Crescent, Cardiff
Telephone: Cardiff 32080
Electrical Engineers and Contractors

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
117 Woodville Road, Cardiff
Telephone 21281-2 *Telegrams: "Whelect"*

CLARKE BROS. (Stroud) LTD.
High Street, Merthyr Tydfil
Telephone: Merthyr Tydfil 377
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

MERSEYSIDE & N. WALES

TROUGHTON & YOUNG LTD.
46 Rodney Street, Liverpool 1
Telephone: Royal 9231-2
Electrical Engineers and Contractors

H. J. CASH & CO. LTD.
28 Chapel Street, Liverpool 3
Telephone: Central 0452
Electrical Engineers and Contractors

YORKSHIRE

Electrical Engineers and Contractors
SOUTHERN & REDFERN LTD.
Woodhead Road, Bradford 7
Textile Maintenance, Repairs and Rewinds
Telephones: Bradford 23871 – Late Phone: Bradford 65837

EDMUNDSONS CONSTRUCTION CO. LTD.
Electrical Engineers and Contractors
2 Hartley Hill, Leeds 2
Telephone: Leeds 33791

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
44 Bank Street, Sheffield 1
Telephone 24015 (3 lines) *Telegrams: "Whelect"*

NORTH WESTERN

H. J. CASH & CO. LTD.
28 Chapel Street, Liverpool 3
Telephone: Central 0452
Electrical Engineers and Contractors

STEWART THOMSON & SONS (Liverpool) LTD.
Fort Road, Seaforth, Liverpool 21
Repairs and Rewinds A.C. and D.C. to 3,000 horsepower. Breakdowns, Urgent Repairs, etc. 24-hour service
Telephone: Bootle 2697-8

DRAKE & GORHAM (Contractors) LTD.
21 Newton Street, Piccadilly, Manchester 1
Telephone: Manchester Central 4701
Electrical Engineers and Contractors

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
Regal Buildings, Oxford Road, Manchester 1
Telephone: Central 8207-8

Industrial Installations
W. H. SMITH & CO. ELECTRICAL ENGINEERS LTD.
12 York Street, Manchester 2
Telephone: CENtral 2991-6
Works: Praed Road, Trafford Park, Manchester 17

THE NELSON ENGINEERING CO. LTD.
Telephone: Nelson 1545/6
Electrical and Mechanical Engineers.
Complete Industrial Installations. Rewinds
Netherfield Road, Nelson

EDWARD DEWHURST LIMITED
Mount Street Works, Preston
Telephone : Preston 3281
Electrical and Mechanical Engineers, Complete Industrial Installations, Rewinds, Factory Maintenance, Special Switchboards, etc.

NORTH EASTERN

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
52 Elswick Road, Newcastle
Telephone: Newcastle 36271

Applications for particulars of costs and standard style of advertisements in this Regional Guide should be addressed to :

THE
ADVERTISEMENT DEPARTMENT,
ELECTRICAL REVIEW,
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1

RODENE TIMERS
FOR MOST AUTOMATIC CONTROL NEEDS!

The "Rodene" high torque instant start, synchronous Timer-Motor with built-in automatic clutch.

Self-reset and Multi-cam Timers.

Made in England.

SEND FOR LIST R.I.

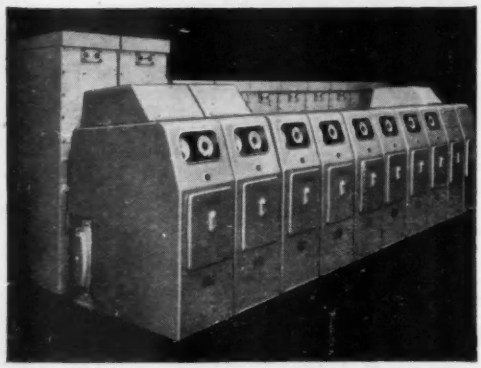
D. ROBINSON & CO. Tel: Hounslow 6266/7
717 LONDON ROAD, HOUNSLOW, MIDDX.

سب صیکی ع

The INDIANS have a word for Yorkshire Switchgear

...three words, *in fact*—sab thik hai! *(everything is right)*

The Government of Mysore selected Yorkshire Switchgear H.T. equipment for five primary distribution sub-stations on their 11kV network. The metalclad switchboards together with complex relay and control apparatus is fully tropicalised for outdoor service.
The equipment must work—unfailingly—in severe climatic conditions; monsoon rains, high humidity, dust laden winds and temperatures varying between 50°F and 140°F.
No wonder the Government of Mysore entrusted the job to Yorkshire Switchgear!

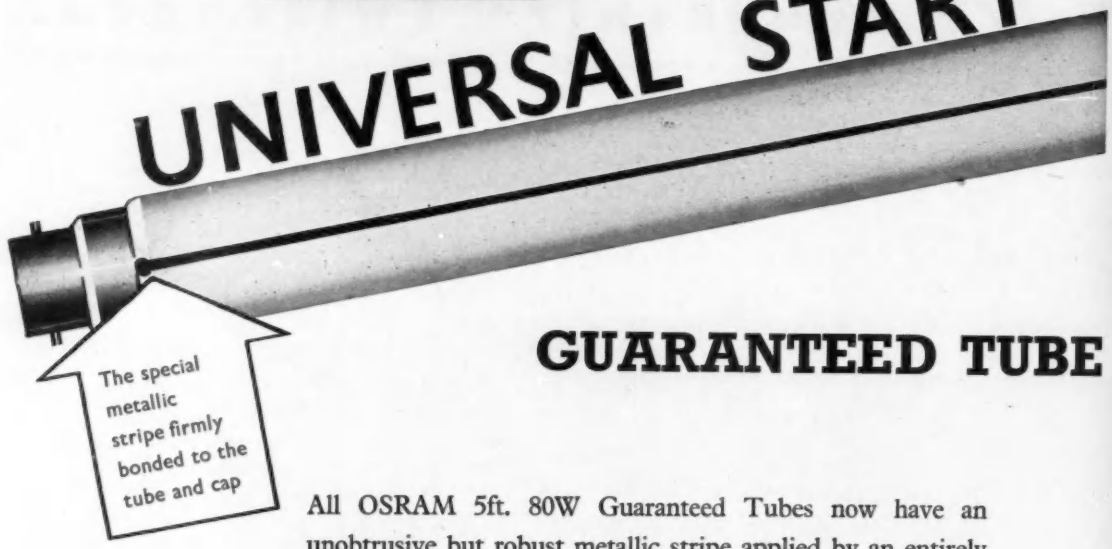


YORKSHIRE SWITCHGEAR
& ENGINEERING CO. LTD.
LEEDS 6 Tel. Leeds 57121-5

London: Grand Buildings, Trafalgar Square, W.C.2
Tel: Whitehall 3530
Also Electro Mechanical Manufacturing Co. Ltd., Scarborough.

ndh 308

NEW Osram UNIVERSAL START



GUARANTEED TUBE

All OSRAM 5ft. 80W Guaranteed Tubes now have an unobtrusive but robust metallic stripe applied by an entirely new technique.

The OSRAM 5ft. 80W Universal Start tube (List price 13*s.* plus P.T.)—suitable for switch or switchless start circuits—means . . .

- Fewer types to stock
- Simplified ordering
- Lower installation and maintenance costs

★ ***Extra charges for metal stripe or silicone finish are now abolished on all OSRAM Guaranteed tubes***

Osram FOR PROGRESS & SUPERB QUALITY

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Advertisements are accepted up to first post on Monday of the week of issue

If displayed with boxed rules, name or symbol block by Friday prior to week of issue

All communications to be addressed to: Classified Advertisement Department, ELECTRICAL REVIEW Dorset House, Stamford Street London, S.E.1

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

NOBLE'S ISLE OF MAN HOSPITAL

Central Heating Station, Multi-Purpose Ward Block and Twin Operating Theatre Unit

To Registered Electrical Contractors

REGISTERED Electrical Contractors who desire to tender for work in connection with the

Sub-Contract (a) Central Heating Station, and/or

Sub-Contract (b) Multi-Purpose Ward Block and Twin Operating Theatre Unit

being erected on the Hospital site in Westmoreland Road, Douglas, are invited to submit their names for consideration.

The installation, particularly in the case of (b), is complex and of very considerable size, and only contractors who have sufficient labour and resources to undertake such work should submit their names. A team of six pairs will be required in connection with (b), all of whom must be very experienced men in their trade. The names of architects to whom reference can be made in respect of works carried out by contractors should be stated in the application. The plans and specifications may be inspected at the office of the Hospital's Architect, Mr. W. T. Quayle, F.R.I.C.S., F.I.A.A., 29, Athol Street, Douglas. The names of the contractors will be given full consideration and a selected list will then be asked to submit firm tenders.

Applications to be submitted to the undersigned on or before noon of Monday, 8th December, 1958.

E. C. KNEALE,
Secretary, Hospital Management Committee.

Noble's Isle of Man Hospital,
Douglas, Isle of Man.
18th November, 1958. 5616

BOROUGH OF WILLESDEN

Street Lighting

Scheme A: Craven Park (part), Church Road, High Road, Willesden Green, Walm Lane (part), Chichele Road

Scheme B: Coronation Road (part), Acton Lane (part), North Acton Road (part)

TENDERS are invited from experienced contractors for the following Group "A" lighting work to be carried out as separate contracts over a length of approximately four and a half miles of highway:—

(a) Supply of sodium lanterns and ancillary equipment.

(b) Supply and erection of concrete columns, wiring and fixing of lanterns and ancillary equipment.

The contract documents may be obtained from the Borough Engineer and Surveyor, Town Hall, Dyne Road, Kilburn, London, N.W.6, upon application accompanied by a deposit of two guineas, which will be returned on receipt of a bona fide tender not subsequently withdrawn.

Sealed tenders must be submitted so as to reach the undersigned by not later than 10 a.m. on the 19th December, 1958.

R. S. FORSTER,
Town Clerk.

Town Hall,
Dyne Road, Kilburn,
London, N.W.6. 5581

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Orrin Project

Pilot Cable Installation for Corrin Power Station

TENDERS are invited for the supply and installation of pilot cables for the control of Orrin Power Station, Ross-shire.

Tender documents may be obtained from the Engineers, Messrs. Merz & McLellan, 72a, George Street, Edinburgh, 2, on receipt of £2 2s. deposit (returnable).

The Board do not bind themselves to accept the lowest or any tender. 5614

BOROUGH OF LUTON

TENDERS invited for supply and delivery to Luton of 611 Street Lighting Columns 15 ft. mounting height.

Documents from Borough Engineer, Town Hall, Luton, on payment of £2 2s. deposit, returnable after receipt of bona fide tender not subsequently withdrawn. Cheques payable "Luton Corporation."

Tenders to Town Clerk, Town Hall, Luton, by first post 15th December, 1958. 5615

SITUATIONS VACANT

EAST MIDLANDS ELECTRICITY BOARD

Senior Draughtsman (Civil), Ilkeston and North Derbyshire Sub-Area (Planning and Construction)

APPLICATIONS are invited for the position of SENIOR DRAUGHTSMAN (Civil) in the Ilkeston and North Derbyshire Sub-Area of the East Midlands Electricity Board.

Applicants should be capable of undertaking the preparation of detailed drawings and diagrams relating to substation plant and equipment, including site surveys, design of control buildings, concrete structures and foundations, and all civil works associated with modern practice in step-down substations.

The possession of suitable qualifications and experience in the preparation of bills of quantities would be advantageous.

The salary and conditions for the post will be in accordance with the National Joint Board Agreement, Schedule D, Grade 4 (£895 × £20 to £995 per annum).

Applications stating age, experience, qualifications, previous and present appointments should be forwarded to the Manager, Ilkeston and North Derbyshire Sub-Area, East Midlands Electricity Board, 1, Derby Road, Ilkeston, Derbyshire, so as to reach him within fourteen days of the date of this advertisement. 5631

LEADING ELECTRICAL WHOLESALER

reorganising present sales staff requires additional

REPRESENTATIVE FOR GLOUCESTER AND WILTSHIRE.

Sound knowledge of wholesaling and existing connections essential.

Superannuation scheme in operation. Car provided.

Write stating experience, age, etc., to

Box 5560

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:—

Central Gloucestershire Sub-Area

FIRST ASSISTANT DISTRICT ENGINEER
(Severn Vale District).

Applicants should have had a sound technical training and experience in all branches of distribution work, including operation, maintenance, construction and planning of H.V. and L.V. distribution systems, substations, etc. Technical qualifications desirable. Salary £935/£995 per annum (N.J.B. Grade E.5).

Apply by letter, within 14 days, stating age, experience, present position and salary to Mr. S. Raybould, Sub-Area Manager, Central Gloucestershire Sub-Area, Midlands Electricity Board, 126, London Road, Gloucester.

North Staffs Sub-Area

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER
(Stoke South District).

Applicants should have had a sound technical training and wide practical experience in the sale and installation of domestic and commercial electrical equipment and the work associated therewith. The successful applicant will be required to assist on all branches of commercial work, including advising consumers on domestic, commercial and industrial equipment, estimating and contracting work. Technical qualifications desirable. Salary £885/£930 per annum (N.J.B. Grade G.8).

Apply by letter, within 14 days, stating age, experience, present position and salary to Mr. C. C. Pimble, Sub-Area Manager, Midlands Electricity Board, 234, Victoria Road, Fenton, Stoke-on-Trent.

Worcester and District Sub-Area

DEMONSTRATOR (Female)
Kidderminster District).

Applicants must have had a good education and should have a certificate of a recognised domestic training college and/or the E.A.W. Certificate. Some selling experience would be an advantage. Duties include lecture demonstrations in service centres and on consumers' premises and advice to consumers on the selection and use of electrical apparatus. Applicants must be prepared to take an active part in the sales organisation. Salary £525/£625 per annum (N.J.C. Grade 1).

Apply by letter, within 14 days, stating age, education, qualifications, training and experience to Mr. R. Mallet, Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

A. STEPHENS,
Secretary. 5620

NORTH EASTERN ELECTRICITY BOARD

Tees Sub-Area

APPLICATIONS are invited for the appointment of FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER, Hartlepools District.

Salary Schedule A, Class F, Grade 5, £995/£1,055. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by the Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 5601

Situations Vacant (continued)

AUTOMATIC TELEPHONE & ELECTRIC CO. LTD.

LIVERPOOL

THIS company is engaged on large-scale projects which offer a real challenge to those seeking an outlet for their scientific or engineering abilities and affords excellent opportunities for experience and advancement. The work involves the design and manufacture of electronic equipment using solid state devices and the most modern electronic techniques.

The programme of work is expanding and in consequence there are staff vacancies at all levels in the following fields:

(a) Research and development work on components and electronic devices.

(b) Design of systems and circuits utilising digital and analogue techniques.

(c) Engineering design for production.

(d) Commissioning and field trials.

Suitable academic qualifications range from an Ordinary National Certificate in Electrical Engineering to an Honours Degree in Electrical Engineering, Mechanical Engineering, Mathematics and Physics. A limited number of posts are available for persons with postgraduate academic training.

Practical experience in the field of light current engineering is desirable, but adequate training will be given to applicants who are suitably qualified but lack this practical experience.

Salaries will be realistic and will be determined by qualifications, experience and the type of responsibility. Successful applicants will be required to join the company's generous contributory pension scheme.

Assistance with housing and removal would be given in approved cases.

Any person who feels qualified to contribute to this work should apply for an application form to the:—

Personnel Manager
AUTOMATIC TELEPHONE & ELECTRIC CO. LTD.
Strowger Works, Liverpool, 7

5556

AIR MINISTRY

STATION ENGINEERS (G.D.) and STATION ENGINEERS (Mech.) required at R.A.F. and M.T.C.A. stations. Qualifications required: (a) O.N.C. Elec. or Mech. or equivalent; (b) recognised apprenticeship in electrical or mechanical engineering with firm or establishment of good repute; (c) 3 years' employment in electrical or mechanical engineering, preferably on operation and maintenance of mine, factory or workshops plant and services. Preference given to candidates with supervisory experience subsequent to (b) and (c).

Work consists of installation, operation and maintenance of high and medium-voltage electrical distribution system electrical installation, generating plant, steam and hot water heating systems and miscellaneous works plants, tools and equipment.

Commencing salary according to age, qualifications and experience on range £655-£820. Promotion and pensionable prospects and opportunities for overseas tours for which special allowance payable in addition to higher salary.

Applications normally from natural-born British subjects only, up to age 55 years. Write giving age, full details of qualifications and experience, quoting (PE.3140), to Manager, Ministry of Labour and National Service, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4. 398

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division:—

ASSISTANT MAINTENANCE ENGINEER (Mechanical), STAYTHORPE POWER STATION (Vacancy No. 172/58/ER).

Applicants should have received a sound technical training and have had wide practical experience in the maintenance of power station mechanical plant. A house may be made available if the successful applicant so desires.

The salary will be in accordance with Class K, Grade 7 (£1,160-£1,235 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1958.

FOURTH ASSISTANT ENGINEER, STAYTHORPE TRANSMISSION SECTION (Vacancy No. 173/58/ER).

Applicants should have experience of the maintenance and operation of E.H.T. overhead lines, transformer and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 8 (£710-£935 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1958.

The following vacancies are at High Marnham Power Station, which is now under construction. The ultimate capacity of this station will be 1,000 MW. The power station is situated in a rural area on the River Trent, approximately fourteen miles south of Gainsborough and five miles east of Tuxford in the county of Nottinghamshire.

OPERATION SUPERINTENDENT, HIGH MARNHAM POWER STATION (Vacancy No. 175/58/ER).

Applicants should have wide experience of the operation and maintenance of a large modern power station with P.F. boiler plant. The successful applicant will be responsible to the Station Superintendent for ensuring that all sections of the plant attain the specified efficiency and for the carrying out of special investigations and tests.

The possession of the Higher National Certificate or equivalent would be an advantage.

The salary will be in accordance with Class L, Grade 4 (£1,560-£1,665 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1958.

MAINTENANCE ENGINEER (Electrical), HIGH MARNHAM POWER STATION (Vacancy No. 177/58/ER).

Applicants should have had a good general education and technical training. A wide experience in the maintenance of E.H.T. switchgear and power station electrical auxiliaries is essential.

Qualifications entitling to graduate membership of the Institution of Electrical Engineers would be an advantage.

The salary will be in accordance with Class L, Grade 5 (£1,435-£1,540 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1958.

MAINTENANCE ENGINEER (Mechanical), HIGH MARNHAM POWER STATION (Vacancy No. 178/58/ER).

Applicants should have had a good general education and a fundamental training in mechanical engineering including workshops, and should preferably have experience in the maintenance of mechanical plant as installed in a modern power station.

Qualifications entitling to graduate membership of the Institution of Mechanical Engineers would be an advantage.

The salary will be in accordance with Class L, Grade 5 (£1,435-£1,540 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th December, 1958.

SHIFT CHARGE ENGINEERS, HIGH MARNHAM POWER STATION (Vacancy No. 176/58/ER).

Applicants should have had a sound technical training and considerable experience in a large modern power station. The possession of the Higher National Certificate or equivalent would be an advantage.

The salary will be in accordance with Class L, Grade 6 (£1,325-£1,415 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 10th December, 1958.

STATION SHIFT CONTROL ENGINEERS, HIGH MARNHAM POWER STATION (Vacancy No. 174/58/ER).

Applicants should have had a sound technical training and practical experience in a modern power station. Preference will be given to applicants who possess the Higher National Certificate or its equivalent.

The salary will be in accordance with Class L, Grade 10 (£995-£1,055 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 10th December, 1958.

These appointments will be pensionable under the terms of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

O. S. WOODS,
Divisional Controller.

20th November, 1958. 5599

THE ENGLISH ELECTRIC CO. LTD.

KIDSGROVE WORKS

DIGITAL COMPUTER ENGINEERS

THE company is considerably expanding its activities in the field of Special Purpose Digital Computers, and is building new development laboratories pleasantly located on the Staffordshire/Cheshire border. There are a number of vacancies for SENIOR DESIGN ENGINEERS in the computer team.

Candidates should have had experience of logical and circuit design of computers, but consideration will be given to candidates having experience in the design of other complex pulse circuitry.

Attractive staff pension scheme and three weeks' holiday from second year of service. Unfurnished tenancy of recently built houses will be available after an initial period. Assistance with house purchase can also be considered in selected cases.

The company also has vacancies for—

SITE COMPUTER ENGINEERS

for diagnosis of logic and circuitry faults at operational establishments. Successful applicants will, after an initial training course, be required to take up responsible positions at computer installations on customers' premises.

Qualifications required are H.N.C. or equivalent, with preferably two years' experience in design of computer or other pulse circuitry. During training special subsistence allowance will be made for any successful applicants who have to live away from home. Very attractive salaries would be offered with these positions, which are permanent and enjoy the benefits of the English Electric staff pension scheme, and qualify, after initial service, for three weeks' annual holiday.

Applications giving details of qualifications and experience should be addressed to Dept. C.P.S., Marconi House, 336/7, Strand, London, W.C.2, quoting reference ER.306P.

5613

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or B. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT MAINTENANCE ENGINEER (Mechanical), WEST HAM POWER STATION (Vacancy No. 58/970).

Applicants should have had a sound practical and technical training and previous experience of power station mechanical maintenance is desirable.

Salary Class H, Grade 9 = £935 p.a.

STATION SHIFT CONTROL ENGINEER, HACKNEY POWER STATION (Vacancy No. 58/971).

Sound engineering training with some experience in control and operation of steam generating plant and main switchgear in modern power station.

Salary Class H, Grade 10 = £885 p.a. plus £83 10s. p.a. shift allowance.

ASSISTANT ENGINEER (Efficiency and Testing), DEPTFORD WEST POWER STATION (Vacancy No. 58/972).

Sound technical training with experience of efficient operation of power station plant, including testing.

Salary Class J, Grade 12 = £830 p.a.

ASSISTANT MAINTENANCE ENGINEER (Instruments), DEPTFORD WEST POWER STATION (Vacancy No. 58/973).

Good technical training with experience of turbine and boiler plant instruments.

Salary Class J, Grade 12 = £830 p.a.

FOURTH ASSISTANT ENGINEER (Efficiency and Testing), GENERATION (Operation) DEPT., DIVISIONAL HEADQUARTERS (Vacancy No. 58/974).

Candidates should have a good technical education and experience in testing and/or operation of power station mechanical plant.

Salary Class AX/EX, Grade 8 = £750-£985 per annum.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 8th December, 1958. 5587

THE ELECTRIC CONSTRUCTION COMPANY LTD.

has an attractive vacancy for

ESTIMATING AND INDOOR SALES ENGINEER

at

Area Offices for Scotland in Glasgow.

Required to prepare estimates of, and to handle correspondence for, industrial electrical equipment. Technical education to National Certificate standard (minimum). Preferably in 24/32 age group, with knowledge of handling stock.

Progressive position for successful applicant, who will participate in sound pension and profit-sharing schemes.

Apply, in writing, giving details of education, training and experience, to—

The Area Manager
E.C.C. LTD.
Bushbury House, 5, Woodlands Terrace Glasgow, C.3

5606

TRANSFORMER DESIGNERS AND DRAUGHTSMEN

DUE to expansion there are several vacancies for senior and junior men with experience on sizes up to 10 MVA.

Applications invited or confidential, informal discussion arranged.

Apply S. Slingsby, M.I.E.E., Group Personnel Officer, Gresham Transformers Limited, Hanworth, Middlesex. 5627

ENGLISH ELECTRIC
STAFFORD

offer appointments in

TENDERING AND CONTRACT ENGINEERING
for
HEAVY ELECTRICAL PLANT

APPLICATIONS are invited from electrical engineers to deal with the compilation of tenders and estimates and the co-ordination of contracts for the following types of heavy electrical plant :—

RECTIFIERS.
MACHINES.
HEAVY SWITCHGEAR.
POWER TRANSFORMERS.

This work provides an opportunity to gain valuable experience of up-to-date and heavy electrical techniques and applications as well as offering a secure and promising career in a stable industry.

Applicants should possess H.N.C. (E.) or higher qualification. Engineers who are in the last year of the course will, however, be considered.

Membership of the staff pension scheme and eligibility for three weeks' holiday follow a qualifying period of service.

Please write giving full details to Dept. C.P.S., Marconi House, 336/7, Strand, London, W.C.2, quoting reference ER.1297W.

5603

TECHNICAL INSTRUCTORS (ELECTRICAL)

required by NIGERIA FEDERAL GOVERNMENT EDUCATION DEPARTMENT for (a) Yaba Technical Institute, Lagos, for up to three tours of 9/10 months each in first instance (M2C/50172/EF), and (b) Yaba Trade Centre, Lagos, for one tour of 12/24 months in first instance (M2C/50173/EF).

Salary according to qualifications and experience in scale (including inducement addition) £834 rising to £1,386 a year, with resettlement grant at rate of £100/£150 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards children's passages and grant up to £150 annually towards maintenance in U.K. Liberal leave on full salary.

Candidates, preferably not less than 25 years of age, must have served a full apprenticeship and be experienced practical tradesmen. Experience of apprentice training and teaching experience an advantage.

Candidates for post (a) should possess Final C. and G. Certificate in Electrical Engineering Practice, which must include in Part II of the Final, Sections B and C, Generation and Transmission, Distribution, etc., or a C. and G. Electrical Technician's Certificate in Power Generation and Supply. Ability to teach Radio Service Work an advantage. For post (b) candidates should possess C. and G. Certificates in Electrical Installation, Courses B and C, or equivalent.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote reference shown against the post applied for. 5553

INSTRUMENT ENGINEER

required by city consulting engineers. Intimate experience of modern power station practice essential and familiar with pneumatic and electronic systems. Knowledge desirable of telecommunications and protective systems for power circuits.

Good salary and prospects. Pension fund. 5-day week. Free luncheons.

Write details age, qualifications and experience (I.A.M./141), Balfour, Beatty & Co. Ltd., 66, Queen Street, London, E.C.4. 5629

BOXALL ENGINEERING LIMITED, KHARTOUM

APPLICATIONS are invited for the post of ELECTRICAL ENGINEER to be directly responsible to the Manager of the Company. Applicants should be qualified engineers, preferably in the age group 28-35, with a wide general electrical engineering experience. Preference will be given to candidates who possess a knowledge of commercial and sales procedures, and previous overseas experience will be an advantage.

The company represents a number of leading British manufacturers covering a wide field of mechanical and electrical engineering and has established connections with Government and private clients. The company has continuously expanded its activities in recent years and there is ample scope for initiative and hard work.

Conditions of appointment will include an adequate salary, commensurate with age, qualifications and experience, free house, furniture, car, provident fund, life insurance, medical scheme and other allowances. Regular leave with passages paid is granted for the employee and his family.

Applications should be addressed to the Company's London Agents, Messrs. Fendrake Limited, 20, Fenchurch Street, London, E.C.3, marked for the personal attention of Mr. H. R. Holland, and must be received on or before the 4th December, 1958. 5586

ROYAL NAVAL SCIENTIFIC SERVICE

SENIOR SCIENTIFIC OFFICERS and SCIENTIFIC OFFICERS required for establishments in London area, Baldock, Portsmouth, Portland, Poole, Greenock and Rosyth. Main requirements are about 25 vacancies for PHYSICISTS, ELECTRONIC ENGINEERS and MATHEMATICIANS in areas specified.

The following particular vacancies also exist: MECHANICAL ENGINEER for work on gas turbine problems in the London area. MECHANICAL ENGINEER for work on design and development of U/W devices in Portland area. METALLURGISTS for Rosyth and Poole. CHEMISTS (Physical and Inorganic) for Poole area, Baldock and London.

Candidates must normally be natural-born British subjects of natural-born British parents, with at least First or Second Class Honours degrees or equivalent high professional attainments. S.S.O.s must have had at least three years' postgraduate experience and be not less than 26 years of age.

Salaries (men): S.S.O. £1,190-£1,410; S.O. £635-£1,110 (London); somewhat lower in Provinces. Appointments unestablished (with F.S.S.U. benefits), but opportunities may occur for those between ages of 21 and 32 to compete for established posts.

Forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting A98/8A. 5164

CENTRAL ELECTRICITY BOARD, MAURITIUS

(General Manager, A. N. Bott, M.I.E.E.)

DEPUTY GENERAL MANAGER AND CHIEF ENGINEER

required on contract for 3 years in the first instance with possibility of permanent and pensionable employment. Fixed salary according to qualifications and experience between £2,025 and £2,250 a year payable in local currency. Housing allowance equivalent to £180 a year. Gratuity at rate of £200 a year whilst serving on temporary terms. Free passages for officer and wife and assistance towards children's passages. Liberal leave on full salary.

Candidates, preferably over 40 years of age, should be Corporate Members of the Institution of Electrical Engineers and have had extensive experience in the engineering aspects of public electricity supply in the fields of either (a) Generation, including hydro, or (b) Transmission and distribution, including rural electrification. In either case it is essential that candidates should have had substantial experience in the managerial and administrative control of electricity supply organisation. Knowledge of French an advantage.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M26/50227/EF. 5583

Situations Vacant (continued)

SOUTH EASTERN ELECTRICITY BOARD

CARTOGRAPHIC DRAUGHTSMAN, East Sussex and S.W. Kent Headquarters.

Salary £640 × £20 to £700 per annum under N.J.C. Grade 2. Superannuable.

Applicants should have had experience in the preparation of mains records, schematic diagrams, wiring diagrams and general drawing office routine.

Applications quoting TER, and naming 2 referees, to East Sussex and S.W. Kent Manager, SEEBOARD, Westlords, Willingdon Road, Eastbourne by 10th December, 1958.

DISTRICT COMMERCIAL ASSISTANT, Twickenham and Richmond District.

Salary £720 × £20 to £780 per annum under N.J.C. Grade 3, plus London weighting. Superannuable. Applicants of good general education should be fully experienced and able to advise on all supply matters including the application of the Board's tariffs, sales of domestic appliances and the preparation of quotations for domestic, commercial and industrial electrical installations. A knowledge of the basic principles of space heating, particularly as applied to off-peak loads is essential.

Applications quoting TER, and naming 2 referees, to District Manager, SEEBOARD, 42, York Street, Twickenham, by 10th December, 1958.

GEORGE WRAY,
Secretary.
5622

JOSEPH LUCAS (ELECTRICAL) LIMITED

ASSISTANT ELECTRICAL DESIGN ENGINEER

required for the design of rotating electrical machines and electro-magnetic devices. Projects will include fundamental design investigations, and full scope will be given for initiative and imagination.

The post is permanent and pensionable.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Limited, Great King Street, Birmingham, 19, quoting reference PM/D/221.

125

CENTRAL ELECTRICITY GENERATING BOARD

ASSISTANT HEALTH PHYSICISTS required for BRADWELL AND BERKELEY NUCLEAR POWER STATIONS to assist the Station Health Physicist in supervising personnel safety and radiological measurements in an around the station.

Good scientific qualifications are required, preferably of degree standard, and some industrial experience in a responsible position would be an advantage. Specialised knowledge of health physics is not essential as the successful candidates will be given a course of training expected to last approximately six months.

Salary within the range £1,325-£1,415 per annum.

Application forms obtainable from I. G. Ellis, Personnel Officer, 24/30, Holborn, London, E.C.1, should be completed and returned by 2nd December. Please mark envelopes "Confidential—Ref. ER/362." 5617

ELECTRICAL ENGINEERS

required for Engineering Department of Automatic Motor Control Gear Makers in West Midlands.

The work comprises the derivation of schematic diagrams, selection and layout of components and issue of works manufacturing instructions.

A pension scheme is in operation and assistance towards removal expenses will be paid in approved cases.

Apply in confidence stating age, experience and salary required to—Box 5590.

EAST MIDLANDS ELECTRICITY BOARD

Second Assistant District Engineer, Loughborough District, Leicester Sub-Area

APPLICATIONS are invited from suitably qualified and experienced engineers for the appointment of SECOND ASSISTANT DISTRICT ENGINEER in the Loughborough District of the Leicester Sub-Area.

The duties of the position will be to assist in the construction, operation and maintenance of underground and overhead distribution systems up to and including 11 kV.

The successful candidate will be required to reside in or near Loughborough, hold a current motor driving licence, and be prepared to undertake standby duties.

The conditions of service and salary will be in accordance with National Joint Board Agreement, Class F, Grade 7 (£885 × £15 to £930 per annum).

Applications, stating age, qualifications, previous experience, present position and salary, should be forwarded to the Manager, Leicester Sub-Area, East Midlands Electricity Board, Charles Street, Leicester, so as to reach him within fourteen days of the publication of this notice. 5632

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule A or B. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

FOURTH ASSISTANT ENGINEER
(Metallurgy Section),
DIVISIONAL CHEMIST DEPT.,
BATTERSEA POWER STATION
(Vacancy No. 58/975).

Duties include non-destructive testing of power plant. The work involves use of magnetic, ultrasonic and in near future radiographic techniques, and some experience of these and knowledge of electronics an advantage. Minimum qualifications O.N.C. in Engineering or equivalent.

Salary Class AX/EX, Grade 8 = £750-£985 per annum.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 8th December, 1958. 5588

EAST MIDLANDS ELECTRICITY BOARD

Third Assistant Engineer, Planning and Development, Leicester Sub-Area

APPLICATIONS are invited from suitably qualified and experienced engineers for the appointment of THIRD ASSISTANT ENGINEER in the Planning and Development section of the Leicester Sub-Area.

The duties of the postion will be to assist in the design and construction of underground and overhead systems up to and including 11 kV.

The successful candidate will be required to reside in or near Leicester, and should hold a current driving licence.

The conditions of service and salary will be in accordance with National Joint Board Agreement, Class J, Grade 10 (£885 × £15 to £930 per annum).

Applications, stating age, qualifications, previous experience, present position and salary, should be forwarded to the Manager, Leicester Sub-Area, East Midlands Electricity Board, Charles Street, Leicester, so as to reach him within fourteen days of the publication of this notice. 5633

COUNTY BOROUGH OF EAST HAM

Housing Department

Clerk of Works (Electrical)

APPLICATIONS are invited for the above appointment. Salary in accordance with Grade APT. I (£575 × £30 to £725 per annum) plus London weighting.

Further particulars and form of application (returnable by 5th December, 1958) from the Town Clerk, Town Hall, East Ham, London, E.6. 5538

DESIGN & STANDARDS ENGINEER

Age 27 - 35

required for progressive company manufacturing a wide range of Domestic Electrical Appliances. Applicant must possess a recognised professional qualification. Extensive design and manufacturing experience in the light engineering field essential; successful applicant must be capable of controlling Material and Labour Standards and Inspection Dept., and must have a critical and constructive knowledge of tool-making.

The post offered is a permanent one and carries superannuation and sick and benevolent entitlements.

Commencing salary £1,250 rising to £1,500 p.a.

Apply in writing only giving details of age, education and experience, together with copy reference, to :—

The Managing Director
AIBHLEISI EIREANNACHA TEORANTA
Dunleer, Co. Louth

5604

SOUTH WESTERN REGIONAL HOSPITAL BOARD

APPLICATIONS are invited for the post of CLERK OF WORKS (Electrical) on the staff of the Regional Engineer. Salary £635 × £20 (2) × £25 (3) to £750.

Applicants must have served an apprenticeship in electrical engineering and have had not less than five years' experience supervising site installations employing trades associated with electrical engineering; must be fully experienced in all forms of electrical installation work, including knowledge of distribution systems, substations, site generation plant, lifts, etc.

The post is superannuable and subject to the conditions laid down from time to time by the appropriate Whitley Council. The successful applicant will be expected to travel extensively in the West Country in the course of his duties.

Applications giving full details, with the names of two referees, to be forwarded to the undersigned not later than MONDAY, the 8th DECEMBER, 1958.

M. O. CARTER,
Secretary.
27, Tyndalls Park Road,
Bristol, 8. 5559

JOSEPH LUCAS (ELECTRICAL) LIMITED

Great King Street, Birmingham, 19

ENGINEER

EXPANSION of development of ignition equipment for gas turbines and allied projects creates a vacancy for a practical engineer with experience of design for economic production of electrical apparatus. The work is of a high technical standard and applicants should preferably possess an honours degree.

The post is permanent and pensionable and offers considerable scope for advancement to a progressive engineer.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, 19, quoting reference PM/D/190.

128

DORMAN LONG (STEEL) LTD.

require a working

CHARGEHAND ARMATURE WINDER

at their new Lackenby Works, having sound knowledge of all A.C. and D.C. windings, including equipment used in steelworks, and rolling mill drives up to 8,000 h.p.

Send fullest details to LABOUR OFFICER, LACKENBY WORKS, GRANGETOWN, MIDDLESBROUGH. 80

TECHNICAL INSTRUCTOR (ELECTRICIAN)

required by GOVERNMENT OF NORTHERN REGION, NIGERIA, for two tours of 18/24 months or three tours of 10/12 months, either (a) on agreement with prospect of permanent and pensionable employment in salary scale (including inducement addition) £750 rising to £1,284 a year, or (b) on contract in salary scale (including inducement addition) £810 rising to £1,386 a year, with resettlement grant at rate of £100/£150 a year. Increments within the salary scales will be granted for approved industrial experience. Clothing allowance £45. Free passages for officer and wife. Assistance towards cost of children's passages and grant up to £288 annually. Liberal leave on full salary.

Candidates must have served full apprenticeship and possess Final C. and G. Certificate. They must be practical tradesmen with experience of domestic installation work and the installation and maintenance of generating units. Apprenticeship training or other teaching experience desirable.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/41933/EF. 5554

CENTRAL ELECTRICITY GENERATING BOARD

Northern Project Group

APPLICATIONS are invited for the appointment of

SECOND ASSISTANT ENGINEER
at the
BLYTH POWER STATION, NORTHUMBERLAND.

Salary £1,160/£1,510 p.a. Superannuable.

Applicants should be familiar with problems relating to the planning and progressing of power station construction and have sufficient knowledge of the detailed construction and erection of power station plant to enable them to assess and report upon the progress of plant erection at site. Membership of an appropriate professional institution will be an advantage.

Applications stating age and experience should be forwarded to the Administrative Officer, Central Electricity Generating Board, Northern Project Group, Agecroft Road, Pendlebury, Swinton, Manchester. Closing date 1st December, 1958. Please quote Vacancy No. E.55/N.58/9/R. 5567

MIDDLESEX COUNTY COUNCIL

Education Committee

ENFIELD TECHNICAL COLLEGE
Queensway, Enfield, Middlesex

REQUIRED as soon as possible:—

ASSISTANT GRADE B to teach ELECTRICAL ENGINEERING subjects to Ordinary National Certificate and City and Guilds standard.

Candidates should be University Graduates in Engineering or possess equivalent qualifications, and should have had teaching and/or industrial experience.

Salary in accordance with the Burnham (Technical) Report, 1956, i.e. £650 × £25 to £1,025 plus London allowance and other additions for previous experience as appropriate.

Application forms (foolscap S.A.E.) from the Principal. Closing date 12th December, 1958.

C. E. GURR, M.Sc., Ph.D.
Secretary to the Education Committee.
5624

DOWDING & MILLS LTD.
24, White Post Lane, London, E.9

Engineer Representative

LEADING electrical repair specialists require, due to their London branch expansion, an ENGINEER REPRESENTATIVE of good personality, drive, initiative, and who is prepared to work hard for future rewards.

Experience in electric motor repair or manufacture preferable but not entirely essential.

Good basic salary, bonus, pension scheme and company motor car provided.

Applications, which will be considered in the strictest confidence, to be addressed to the London Sales Manager. 5528

TEST ENGINEERS

INTERESTING work in an expanding organisation is available, for those interested in electrical testing and design, at the E.D.A. Testing House, Leatherhead, Surrey. In these modern laboratories, amid pleasant surroundings, domestic appliances, agricultural and light industrial equipment are tested for the Electricity Boards and the British Standards Institution. Canteen facilities are available and there is a pension scheme. At present vacancies exist in the following grades :—

TEST ENGINEER GRADE II. For those with previous experience in an electrical testing laboratory and who have the Higher National Certificate in Electrical Engineering or Physics. Commencing salary not less than £810 (according to age and experience), rising by £25 p.a. to £935 p.a.

TEST ENGINEER GRADE III. For those with previous experience in an electrical testing laboratory and with knowledge of the design of domestic electrical appliances. Commencing salary not less than £710, rising by £25 p.a. to £835 p.a.

Apply in writing to the Director and Secretary, British Electrical Development Association, 2, Savoy Hill, London, W.C.2, not later than 12th December, 1958. 5569

CENTRAL ELECTRICITY GENERATING BOARD

Northern Project Group

APPLICATIONS are invited from suitably qualified persons for the appointment of

RESIDENT ENGINEER
at the
PADIHAM "B" POWER STATION SITE.

Salary £1,490/£1,840 p.a. Superannuable.

Practical experience of modern power station construction (particularly site organisation) is essential. The successful candidate will be responsible directly to the Project Engineer for the efficient administration of all work at site, including control of mechanical, electrical and civil site engineers, inspectors, etc.

Applications stating age, experience and present employment should be forwarded to the Administrative Officer, Central Electricity Generating Board, Northern Project Group, Agecroft Road, Pendlebury, Swinton, Manchester, to arrive not later than 1st December, 1958. Please quote Vacancy No. E.56/N.58/11/R. 5568

ELECTRICAL SUPERINTENDENT (AVIATION)

required by NIGERIA FEDERAL GOVERNMENT Civil Aviation Department on contract for one tour of 12/24 months in first instance. Starting point to be assessed in salary scale (including inducement addition) £834 rising to £1,386 a year. Gratuity at rate of £100/£150 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards children's passages and grant up to £150 annually towards maintenance in U.K. Liberal leave on full salary.

Candidates should be over 25 years of age with considerable experience in the maintenance of large electrical installations. They should preferably have had extensive overseas experience and possess a knowledge of the installation and maintenance of general plant, including large air conditioning installations, standby diesel generating plant, high and low pressure switchgear, and underground cable distribution. Experience of airport lighting installations an advantage.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/50382/EF. 5566

ELECTRICAL AND ELECTRONICS ENGINEERS

for RADAR and GUIDED MISSILE work for Navy, in Admiralty Establishments, mainly in South of England. Recognised apprenticeship or equivalent training required, together with University Degree, A.M.I.E.E., or exempting qualifications. Age not less than 25.

Salary range £780 at 25 to £1,215. Starting salary according to age up to £1,055 at 34.

Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting reference D118/8A. 5602

CORPORATION OF WILLESDEN

Electrical Engineering Assistant

APPLICATIONS are invited for the appointment of:—

ELECTRICAL ENGINEERING ASSISTANT, salary within Special Grade £750-£1,030 p.a.

London weighting, maximum £30 p.a. is payable in addition to the above salary.

Candidates should possess appropriate qualifications and should have experience in the design of electrical equipment and installation.

The council cannot assist with housing.

Full details and form of application may be obtained from the Borough Engineer and Surveyor, Town Hall, Dyne Road, Kilburn, London, N.W.6, and must be returned to the undersigned not later than 9 a.m. on Monday, 15th December, 1958.

R. S. FORSTER,
Town Clerk.
20th November, 1958. 5625

SOUTHERN ELECTRICITY BOARD

General Assistant Engineer

ALDERSHOT DISTRICT of No. 3 (Portsmouth) Sub-Area, located at Petworth. Salary N.J.B. Class G, Grade 13 (£635-£680 per annum). N.J.B. conditions of service.

Applicants will be required to assist in distribution duties including minor construction work and general maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant, etc., and possess suitable technical qualifications. The appointment will involve standby duties.

The successful candidate will be required to contribute to the Electricity Supply (Staff) superannuation scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, quoting Z.959, not later than 18th December, 1958. 5623

SOUTH-EAST METROPOLITAN REGIONAL HOSPITAL BOARD

APPLICATIONS are invited for the following posts in the Regional Engineer's office :—

SENIOR ASSISTANT ENGINEER and ASSISTANT ENGINEER (Electrical). Salary £1,060-£1,245 and £730-£1,065 respectively. Superannuable. Candidates must possess appropriate qualifications (Corporate Member of the Institution of Electrical Engineers for Senior post), and in addition it is desirable that candidates should have had experience in the preparation of schemes and estimates for electric light and power, electric lifts, etc., including specifications and drawings, site surveys and supervision of site works.

Applications stating age, qualifications and experience, with names of three referees, should reach the Secretary, 40, Eastbourne Terrace, London, W.2, by 13th December, 1958. 5582

HARRIS COLLEGE, PRESTON

Principal:
H. Wilkinson, M.Sc.Tech., Ph.D., A.Inst.P.

REQUIRED for ELECTRICAL ENGINEERING DEPARTMENT: LECTURER or SENIOR LECTURER with Honours Degree in Electrical Engineering and Corporate Membership of I.E.E. to teach to level of I.E.E. Part III examination.

Salary at appropriate point according to previous teaching and/or industrial experience within scales £1,200 to £1,350 or £1,350 to £1,550.

Forms from the Principal.

W. R. TUSON,
Clerk to the Harris Council.
5585

ELECTRICAL ENGINEERS

required for Technical Tendering Department of Automatic Motor Control Gear Makers in West Midlands.

The work comprises the initial engineering of control schemes, the calculation of their cost and the preparation of tenders.

A pension scheme is in operation and assistance towards removal expenses will be paid in approved cases.

Apply in confidence stating age, experience and salary required to—Box 5591.

Situations Vacant (continued)

UNIVERSITY OF BRISTOL

Electrical Engineering Department

VACANCIES, both senior and junior, are likely to occur within the next year or two on the academic staff of this department in either the Power or Radio sections of the department. Salaries and conditions will be according to the usual university scales and standards, with initial salary according to qualifications and experience.

The department has recently been transferred to excellent new premises, and substantially re-equipped. Facilities for research are good, especially in electrical machinery and power.

Persons who contemplate seeking a post on the staff of a university department of electrical engineering either immediately or within the next year or two are invited to submit details of their careers and records to date. Submission of particulars will entail no obligation, either to the applicant or to the university.

H. C. BUTTERFIELD,
Secretary and Registrar.

The University,
Bristol. 395

BRITISH STANDARDS INSTITUTION

AN ELECTRICAL ENGINEER with a good knowledge and experience of electronics is required by the British Standards Institution for work in an expanding section concerned with the approval of all types of electrical equipment. The work is of a varied and interesting nature, including the investigation of many types of electronic plant, equipment and appliances, and the engineer appointed will also have the primary responsibility for the effective functioning of specialised electronic testing equipment in a laboratory.

Applicants should have preferably served an apprenticeship, should have had a comprehensive experience and training in electronic work, and should have technical qualifications equivalent at least to Graduate Membership of the I.E.E.

The salary will be in accordance with age and qualifications in a grade with a present maximum of £1,200 p.a., and applicants should apply in writing to the Establishment Officer, B.S.I., 2, Park Street, London, W.1. 5589

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division (SEF/3.4)

FOURTH ASSISTANT ENGINEER
(Overhead Lines),
TRANSMISSION DEPT.

The successful applicant will be required to supervise contractors and for work at Divisional Headquarters concerning the construction of 275-kV and 132-kV overhead lines. Applicants should preferably possess qualifications admitting to graduateship of the Institutions of Electrical, Mechanical or Civil Engineers. Ex-service officers with engineering experience will be considered.

Salary N.J.B. AX/DX, Grade 8, £710–£910.

Special application forms obtainable only from P. D. A. Oliver, Divisional Secretary, Central Electricity House, High Street, Portsmouth, should be returned by 10th December, 1958. 5618

E.C.C. (MOULDED BREAKERS) LTD.

invite applications for posts as
ELECTRICAL SALESMEN

to sell wide range of moulded case circuit-breakers throughout Scotland.

Applicants should have a live connection in the wholesale/contractor markets and be prepared energetically to carry out an extensive selling programme backed by first-class publicity service.

Applicants should preferably be in the 24/32 age group.

Write in the first instance giving details of training, experience and territories covered to—

The Area Manager for Scotland
THE ELECTRIC CONSTRUCTION COMPANY LTD.
Bushbury House, 5, Woodlands Terrace Glasgow, C.3

5607

EASTERN ELECTRICITY BOARD

Northmet Sub-Area

DISTRICT COMMERCIAL ASSISTANTS
(1) Wood Green District (Ref. 812) 125/58.R.
(2) St. Albans District (Ref. 814) 126/58.R.

The duties will include the preparation of specifications and estimates for all classes of electrical contracting work and advising consumers on utilisation.

Salary N.J.C. Grade 3 (£720–£780) plus London allowance for the Wood Green appointment.

Apply by letter, by 9th December, 1958, to:—
(1) R. A. Voit, M.I.E.E., Manager, Eastern Electricity Board, 13/27, Station Road, Wood Green, London, N.22.
(2) F. J. Drake, Assoc.I.E.E., Manager, Eastern Electricity Board, 107, St. Peter's Street, St. Albans, Herts.

This advertisement replaces vacancy notice No. 113/58.R. issued on 21st October, 1958. 5619

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Aberdeen Area

Amended Advertisement

FIRST ASSISTANT DISTRICT ENGINEER (No. 3 District). N.J.B. Grade F.4 (£1,065 × £25 to £1,140).

Experience in the operation of plant in an urban district at system voltages of up to 33 kV, and of planning and construction up to 11 kV is essential. Superannuable position.

Applications made in response to advertisement of 30th October, 1958, will be considered.

Application forms, obtainable from the undersigned, should be returned not later than MONDAY, 8th DECEMBER, 1958.

J. E. WHITTAKER,
Millburn Street, Area Manager.
Aberdeen. 5626

M.K. ELECTRIC LIMITED

REQUIRE EXPERIENCED SALES

REPRESENTATIVE

FOR NORTH EAST ENGLAND

If you have experience in dealing with architects, electrical wholesalers and contractors, are a car owner and would like to join the sales team of a progressive company marketing products with a world-wide reputation, we would like to hear from you in confidence.

Write in the fullest detail to:—
The Sales Manager
M.K. ELECTRIC LTD.
London, N.18

5580

ENGINEERING FOREMAN

Radiochemical Centre, Amersham

AN apprenticed or similarly trained Technical officer is required by the U.K.A.E.A. (Research Group) for the R.C.C. Amersham, to assist an Engineer in planning and progressing engineering projects including facilities for radio-active processes; to supervise their installation and be responsible for their manufacture. Supervisory experience and a good practical knowledge of mechanical and electrical engineering is more important than directly relevant experience.

Salary £875–£1,050 (Tech. II).

Send a POSTCARD to the Personnel Officer (1151/48), The Radiochemical Centre, Amersham, Bucks, for details. 5584

INSTRUMENT TECHNICIANS

required for a

new chemical company operating in Southern England. The posts are staff appointments, 5-day week with security and generous sickness, superannuation and holiday benefits.

Applications are especially welcomed from those persons with previous experience of pneumatic controllers or industrial electronic equipment.

Housing available after a probationary period.

Full particulars of age, experience, etc., should be addressed to—Box 5630.

LONDON ELECTRICITY BOARD

Engineering Draughtsman

APPLICATIONS are invited for the above position in the West Bourne District, based at South Kensington, London, S.W.7.

Applicants should have had a good general and technical education up to the Ordinary National Certificate standard, and should preferably have had experience in one or more of the following: electrical plant layout, mains survey and recording of mains work, building construction, drawing office routine.

The post is graded under Schedule D of the National Joint Board Agreement as Grade 6, £635 to £755 per annum, inclusive of London allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed by 12th December, 1958. Please quote ref. PER/2551/R. 5600

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 127/ER/58

APPLICATIONS invited for superannuable N.J.B. appointment of MAINTENANCE ENGINEER (Mechanical) at USKMOUTH POWER STATION, Nr. NEWPORT, Mon.

Salary K.5, £1,325–£1,415 per annum.

Applicants should have had wide experience in power station mechanical maintenance, and preferably be Corporate Members of the Institution of Mechanical Engineers or hold equivalent qualifications.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 12th December, 1958. 5598

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT (Estates and Wayleaves) required in the Secretary's Department, No. 1 Sub-Area, 24, Hatton Garden, Liverpool, 3. Salary within range £720/£780 per annum (N.J.C. Grade 3).

Duties, under direction of the Senior Assistant, will include the negotiation of wayleaves, the settlement of compensation claims for damage to crops, etc., and the acquisition of substation sites and other properties.

Appointment subject to medical examination. Pension scheme.

Applications stating age, qualifications, experience, etc., should be forwarded to the Manager, No. 1 Sub-Area, at the above address not later than 9th December, 1958. 5558

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER (Construction)—Substations required in the Sub-Area Engineer's Department at the Construction Depot, Vauxhall, near Wrexham. Salary within range £935/£995 per annum (N.J.B. K/10).

Applicants should have had experience in the construction of substations, and should also have the technical knowledge to enable them to check and test all ancillary gear.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, near Wrexham. Closing date 9th December, 1958. 5557

MINISTRY OF TRANSPORT AND CIVIL AVIATION

ELECTRICAL ENGINEERS (Assistant Signals Officers) required for aviation telecommunications and electronic navigational aids. Minimum age 23, 1st or 2nd Class Degree in Physics or Engineering, or A.M.I.E.E. or A.F.R.Ae.S. (candidates with Parts I, II and III of A.M.I.E.E. or Parts I and II of A.F.R.Ae.S. or equivalent, or of very high professional attainment without these qualifications considered).

Salary £665 (age 23) to £1,085 (age 34). Maximum £1,250. Slightly lower outside London and for women. 5-day week.

Further details and forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D129/8A.

397

MIDDLESEX COUNTY COUNCIL

Education Committee

HENDON TECHNICAL COLLEGE
The Burroughs, Hendon, London, N.W.4

APPLICATIONS are invited for the post of SENIOR LECTURER IN ELECTRICAL ENGINEERING with a bias towards Electronics.

Applicants should be graduates with industrial or research experience. Corporate membership of an appropriate professional institution is essential.

Burnham Technical Salary Scales plus London allowance.

Application forms (foolscap s.a.e.) from the Clerk to the Governing Body, Town Hall, Hendon, London, N.W.4. Closing date 12th December, 1958.

C. E. GURR, M.Sc., Ph.D.,
Secretary to the
Education Committee.

5561

TECHNICAL INSTRUCTOR (ELECTRICAL)

required by the GOVERNMENT OF THE EASTERN REGION, NIGERIA, Ministry of Education, for one tour of 12 to 24 months in the first instance.

Salary according to age and experience, in scale (including inducement addition) £1,002 rising to £1,518 a year. Gratuity at rate of £150 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards children's passages and grant up to £150 a year towards maintenance in U.K. Liberal leave on full salary.

Candidates, preferably under 35, must have served a full apprenticeship, possess a recognised technical qualification such as C. and G. Final Certificate in Electrical Installation, and be experienced tradesmen. Previous teaching and/or trade instruction experience desirable.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/50307/EF. 5555

LONDON ELECTRICITY BOARD

General Assistant Engineer

APPLICATIONS are invited for the above position, based initially at Walworth, S.E.17.

Applicants should have a sound technical education to the standard of the Higher National Certificate, and have completed a recognised period of training in the electricity industry, or have equivalent experience.

Pending determination as to the grading and salary applicable to the post within the National Joint Board agreement, the provisional minimum salary will be £590 per annum rising to £725 per annum, inclusive of London allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed by 6th December, 1958. Please quote ref. PER/2552/R. 5628

A SENIOR ELECTRICAL ENGINEER

with degree or equivalent professional qualifications is required to take charge of electrical design and development. Experience in the design of electro-magnets, solenoids, coil winding and low-voltage switchgear is essential.

Candidates must have enthusiasm, energy and initiative. The salary will be fully commensurate with experience and qualifications. A pension scheme is in operation.

This appointment presents an unusual opportunity for the successful candidate to make a progressive career in one of the smaller old-established firms manufacturing a high-grade specialised product well known in the machine tool industry.

Please write giving full particulars of education, experience and present salary to—

General Manager
J. H. HUMPHREYS & SONS LIMITED
Werneth, Oldham

and mark envelope "Electrical Engineer." 5605

CLASSIFIED ADVERTISEMENTS ARE PREPAID

A SENIOR POSITION

exists in the Sales Dept. of a large firm manufacturing electric motors. The position offers exceptional prospects for advancement. Good theoretical and practical training and subsequent sales experience essential. Preferable age 25 to 35. Apply in confidence stating age, experience, qualifications and salary.—Box 5641.

A CHARGE hand for expanding electric motor repair works. Experience of all types of winding and fitting including outside service. Able to drive. Good rate and opportunity for keen and industrious man.—Lewis Electric Motors Ltd., Moor Works, Blackamoor Lane, Maidenhead, Berks. 5547

A PRODUCTION engineer is required by a medium-size firm who manufacture electrical measuring instruments. The position demands experience of production, tool design and the introduction of manufacturing and assembly methods, particularly on small mechanisms. It will be necessary to ensure liaison between these functions and the design drawing office. The company operates a modern contributory pension scheme. Applications will be treated in confidence and should be sent to—Box 5570.

A QUALIFIED lady demonstrator for the Midlands is required by a national company manufacturing domestic electrical appliances. Applicants should possess domestic science qualifications; previous sales experience is an advantage, although not essential. Please submit full details of your career to date to—Box 5634.

APPLICATIONS are invited for the position of export manager for the domestic radio and television interests of a leading manufacturing company with a considerable export turnover which it is desired to expand. Essential requirements include export sales experience in this or allied fields, administrative ability and knowledge of overseas markets. The position is a responsible one and offers considerable scope for the right man. Write in confidence with brief outline of career to date and qualifications, etc., to—Box 5610.

ARMATURE winder foreman for repair shop, old-established firm, East End London district.—Box 5635.

ASSISTANT works manager required. Must be conversant with electric lamp manufacture. Also vacancy for foreman with knowledge of sealing, stem making or pumping. Replies treated in strictest confidence.—Luxram Electric Limited, Knight Road, Strood, Kent. 9542

BRUCE PEEBLES & Co. Ltd. have a vacancy for a technical sales engineer in their rotating plant sales (quotations) department. Five-day week, staff pension and production bonus schemes; assistance with removal expenses and house purchase where necessary. Applications stating age, qualifications and experience to Manager, Rotating Plant Department, Bruce Peebles & Co. Ltd., Engineers, Edinburgh, 5, quoting reference FH/Sales. 5548

CABLE estimator required in London. Experience in rubber and plastic cable design and estimating. Age 20/25. Write full details in strict confidence to—Box ER.904, c/o 191, Gresham House, London, E.C.2. 5564

CABLE estimator with experience in paper mains cable design and costing required in London. Age 25/30. Write in strict confidence, stating experience and salary required, to—Box ER.905, c/o 191, Gresham House, London, E.C.2. 5563

CENTRIFUGAL pump tester required. Electrical test experience essential. Hydraulic experience desirable. Job interesting and varied. Write giving details, education, training and posts held to—Contracts Manager, The Harland Engineering Company Limited, Canal Road, Timperley, Cheshire. 5572

CIRCUIT engineer. Young man, age 22/26, required for circuitry work associated with automatic control gear. O.N.C. standard preferred. Permanent and progressive position. Pension scheme. Canteen. Apply in writing giving full details of age, experience and qualifications, if any, to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Rd., Hounslow, Middlesex. 5593

DRAKE & GORHAM (CONTRACTORS) Ltd. require estimating engineers with previous experience of estimating for electrical installation contracts. Persons so qualified should write, giving details and stating age and present salary, to — 36, Grosvenor Gardens, London, S.W.1. 5595

COMPETENT chargehand required by light engineering company in the Slough area, for department engaged in winding small A.C. and D.C. motors. Write giving full details of past experience to—Box 5549.

CONTRACTORS (London) invite applications from experienced supervising and estimating engineers, age 35 to 45 years, with object of appointment as contracts manager and eventual executive responsibility. Starting salary £1,250 to £1,500.—Box 5594.

DESIGNER draughtsman. Due to expansion, opening occurs for better than average engineer to join enterprising and enthusiastic team in design, pricing and site execution of electrical installations for all classes of buildings. Creative mind and accuracy essential for this interesting and high calibre work. Write full particulars of experience, age, training and salary required—(M.D.), Alliance Electrical Co. Ltd., 2, Henrietta Street, London, W.C.2. 65

DRAUGHTSMAN required, with experience in electric wiring accessories, by a company well established in this field, situated in the South London area. Only those with experience in this type of work should apply. Additional experience in design for large quantity production plastic moundings - press work is desirable. The position offers a wide scope for initiative. Pension and staff bonus schemes after qualifying period. Write giving full details of age, qualifications, experience and present salary to—Box 5621.

ELECTRIC lamp manufacturer has vacancies for representatives in Lancashire and in the Midlands. Replies with full details of experience, age, salary required to—Box 9544.

ELECTRICAL engineers having B.Sc. or H.N.C. qualification and experience of electrical measurement are required for the design and development of indicating and recording instruments, relays, etc. Applications giving full details of experience, qualifications and salary desired will be treated in strict confidence. The company has a 5-day week, a contributory pension fund and a life assurance scheme. Please address your application to—The Secretary, The Record Electrical Company Ltd., Broadheath, Altrincham, Cheshire. 5571

ELECTRICAL products. Agent required to handle manufacturers' branded output of immersion heaters, oil-filled radiators, greenhouse heaters, soldering irons, etc. North-West area, preferably based on Manchester. Applicants should have established connections with electrical wholesalers, large stores, hardware traders and supply authorities. Full particulars in confidence to—Box ER.555, L.P.E., Romano House, 399/401, Strand, London, W.C.2. 5596

ENGINEER, experienced steel tower work and foundations essential. Good prospects. Electrical engineers and contractors. Pension scheme.—Box 5503.

ESTIMATING engineer. Experience of motor control gear, sequence, auto control and ancillary gear essential. Opportunity for man with experience and ability; pension scheme; 5-day week. Applicants should supply details of experience and present salary to the Managing Director, British Klockner Switchgear Ltd., Chertsey, Surrey. 5413

H. J. CASH & Co. Ltd. require in London an estimating engineer for all types of electrical installation contracts. Only men experienced in taking off quantities for lump sum and schedule prices should apply. The position is permanent, pensionable and offers prospects. Write giving previous experience and salary recently earned to—Caxton House, Tothill Street, London, S.W.1. 407

MANAGER, experienced sales and electrical installations. Sussex area. Good prospects. 30-35. Pension scheme.—Box 5502.

REPRESENTATIVES, experienced, car owners, selling decorative and commercial lighting fittings to the trade, stores and wholesalers. Good salary, commission and expenses. Areas: (1) London and S. Suburbs; (2) West of England; (3) N. and S. Wales; (4) Scotland; (5) The 4 Northern Counties. Write with full particulars to—Box 5562.

REQUIRED for Birmingham, Notts and Leicester area, technical sales representative for wire manufacturers supplying electronic, radio and television industries. Excellent opportunity for keen man genuinely interested in subject. Write stating experience and salary required to—Box 5597.

Situations Vacant (continued)

REQUIRED immediately, electrical detail draughtsman with Ordinary National Certificate and with some experience of abstracting quantities from scheme drawings; age 22-25; 5-day week, pension scheme, generous holiday allowance. Apply in confidence to W. S. Atkins & Partners, 52, Frederick Road, Edgbaston, Birmingham, 15. 5552

SALES department of a firm manufacturing electric motors has a vacancy for a young electrical engineer at their Glasgow office. The position offers good opportunities for a permanent and progressive position. Reply stating age, experience and qualifications to—Box 5520.

SALES representatives required to promote sales of fluorescent fittings on commission basis.—Box 9551.

SENIOR draughtsmen required in West Country. Must have design experience of either components such as contactors, relays, etc., or of complete automatic control and/or switchgear installations. Knowledge of the requirements of the British Admiralty or of Lloyds, etc., for marine equipment an advantage. Pay in accordance with experience but above A.E.S.D. minimum. Good and congenial working conditions; varied and interesting work. Apply in confidence—Box 5454.

SUPERVISING and estimating engineer required immediately by established electrical contractors in the Midlands. Flat available. Apply stating experience and salary required.—Box 9550.

SUPERVISING electrical engineer, highly experienced, required to deal with all types of electrical contracting work throughout the country. Apply—W. J. Furse & Co. Ltd., Electrical Contractors, Traffic Street, Nottingham. 5609

TECHNICAL contractors' estimator required experienced in large and varied types of electrical installation contracts. Apply—W. J. Furse & Co. Ltd., Electrical Contractors, Traffic Street, Nottingham. 5608

THE BRITISH THOMSON-HOUSTON Co. Ltd. has vacancies in its research laboratory at Rugby for electrical engineering graduates for work concerned with electrical insulations. There are also vacancies in the same group for men with National Certificate or similar qualifications. Applicants are invited to write to the Director of Research, The British Thomson-Houston Co. Ltd., Rugby, stating age, and giving full details of education and experience, and quoting reference MIR. 5496

WANTED, estimator/supervisor for East London electrical contractor; contracts up to £50,000. Write giving details of experience, qualifications and salary required to—Box 5573.

YOUNG electrical engineer required to inspect and report on the electrical equipment of a large group of newspaper proprietors at their printing establishments in various parts of the country. This position is suitable for a qualified A.M.I.E.E. with practical experience. Write giving details of qualifications, experience, age, etc., and stating salary required, to General Manager.—Box 5574.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

ELECTRICAL engineer, A.M.I.E.E. (46), resident N. London, seeks responsible post London area with consultants or contractors. Many years' experience design, specifications, administration in oil and chemical industries, of complete power and lighting installations and H.V. and L.V. distribution schemes.—Box 9545.

ELECTRICAL engineer, Grad. I.E.E., Grad. I.Mech.E., seeks change from design engineer consultants to technical sales engineer. Experienced in dealing with clients, architects and contractors.—Box 9532.

ELECTRICAL/mechanical engineer, erection and running of diesel power stations, H.T. and L.T. distribution, all types of internal wiring and domestic apparatus, installation and maintenance of air conditioning and refrigerating plant, maintenance of mechanical plant, fixed and mobile, fifteen years' experience in the Middle East, desires post at home or abroad.—Box 9553.

ELECTRICIAN completed contract in Africa as supervisor seeks post overseas. Very keen.—Box 9538.

SALES representative, experience and qualifications domestic appliances, sound connection electrical boards, wholesalers, contractors, good turnover, car, phone, requires appointment.—Box 9541.

SUPERVISING maintenance electrical engineer, M.A.S.E.E., desires full or part time employment, supervising or otherwise. Over forty years large factory experience control equipment, motor repairs, rewinds, all classes lifts. Sheffield area.—Box 9546.

TECHNICAL representative, A.M.I.E.E., age 36 years, seeks sales management post or position as at present but arranged to eventually lead to executive appointment.—Box 9533.

SALES BY AUCTION

FORTIETH SALE

By Order of the E. R. Minister of Supply

M.O.S. STORAGE DEPOT, RUDDINGTON
(Five miles south of Nottingham on the main Nottingham-Loughborough road)

WALKER, WALTON & HANSON
(in association with
TURNER, FLETCHER & ESSEX
and
RICHARDSON & LINNELL)
will SELL BY AUCTION on
TUESDAY, 9th DECEMBER, 1958
at 10.30 a.m.
a Large Quantity of
GOVERNMENT SURPLUS PLANT AND STORES

including LATHES by Adams, Denham, Le Blond, Graham & Normanton, Southbend, Soag. GRINDING, HONING AND POLISHING MACHINES by Atlas, Bamkin, Buma, B.S.A., Hopkins, Stamford, Orcutt. END SEAM, LONGITUDINAL and SPOT WELDERS by British Federal, Holden & Hunt, Metropolitan Vickers, Neill, Sciaky. GLENFIELD & KENNEDY THREE-THROW HYDRAULIC PUMP. WELLMAN-SEAVER 900-ton VERTICAL HYDRAULIC PRESS. BALLARD GAS-FIRED STOVING OVEN.

Textiles, Hessian Wrappers, Webbing and Web Equipment, Canvas Covers and Canopies, Clothing, Footwear, Rubber Thigh Boots, Stockings, Dresses, Slacks, Trousers, Jerseys, Ties, Helmets, Motor Cyclists' Pantaloons, Boot, Button, Hair, Shaving and Tooth Brushes, Combs.

Vehicle Tool Kits, Tool Bags, Cross-Cut Saws, Hammers, Files, Soldering Irons, Spanners, Electric Drills and Vibro Centric Valve Seat Grinders, Angle Plates, Vee Blocks, Inside and Outside Callipers, Steel Squares, Surface and Screw Gauges, Thread Chasers, Chucks, Gauging and Weighing Machines, Paint and Varnish, Tables, Chairs, Electric Motors, Dynamos, Starter Motors, Distributors, Carburettors, Sparking Plugs, Horns, Head, Side and Tail Lamps, Tyres, Tubes and Flaps, Tyre Foot Pumps, Air Line Hose, 4½-gall. Petrol and Water Cans, Breakdown Ambulances, Auxiliary Charging Sets, Battery Benches, Batteries, &c.

9 DECAUVILLE RUSTON-HORNSBY 2-CYLINDER 20-h.p. DIESEL LOCOMOTIVES.

350 4-ton DECAUVILLE DOUBLE BOGIE DROP SIDE TRUCKS.

ON VIEW: Wednesday, 3rd December, Thursday, 4th December, Friday, 5th December, and Monday, 8th December, 9 a.m. to 4 p.m., and on morning of sale 9 a.m. to 10.15 a.m.

CATALOGUES, price 1s. each (postal orders only), to admit TWO persons to View and ONE PERSON to the Sale, may be obtained from the Auctioneers' Offices, Dept. 3, Byard Lane, Bridlesmithgate, Nottingham (Tel. Nottingham 54272, 7 lines). 5565

ARTICLES FOR SALE

HOUSE SERVICE METERS

200-240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.
UNIVERSAL ELECTRICAL CO.
221, City Road, London, E.C.1 37

ELECTRICAL EQUIPMENT FOR SALE

10-kVA/10-h.p. D.C. and A.C. School or Laboratory Test Set. Output 25 to 60 cycles and 150/500 volts D.C.
Reconditioned Motors.
3-kVA, 230-volt, 1,000/1,100-cycle M.G. Set.
Diesel Alternator Sets.
562-kVA, 300-r.p.m. Alternator, 400/440/3/50 cycles.
Secondhand 5-cwt. Electric Blocks.
SOUTHERN & REDFERN LTD.
Woodhead Road, Bradford, 7
(Tel. Bradford 23871) 404

WHITEFIELD MACHINERY & PLANT LIMITED
Cobden Street, Salford, 6

VARIABLE SPEED COMMUTATOR MOTORS, 400 VOLTS, 3-PHASE, 50 CYCLES

H.P.	Maker.	R.P.M.
65 - 16	B.T.H.	1500 - 360
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40 - 8	B.T.H.	1150 - 230
30 - 7.5	B.T.H.	1500 - 375
30 - 6.6	L.S.E.	2250 - 500
5 - 1.7	L.S.E.	2250 - 750
5 - 1.7	L.S.E.	2250 - 750
4 - 1	B.T.H.	1650 - 413
4 - 1	B.T.H.	1650 - 413

Telephone : Pendleton 4746
307

VARIABLE SPEED MOTORS
500 volts D.C., with Control Gear

One	60 h.p.	480/1450 r.p.m.
One	45 "	850/1430 "
One	40 "	950/1120 "
Six	35 "	480/1450 "
One	35 "	900/2000 "
One	30 "	500/1500 "
Twelve	25 "	850/1420 "

JAMES GRANT & CO.
480, Pollokshaws Road, Glasgow, S.1
5383

ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., s/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.
ALBERICE METER COMPANY
Fairfax Works, Fairfax Rd., London, N.8
(Tel. MOUntview 7944, 6373) 191

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI.5105. 67, Rothschild Rd., London W.4. 57

BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALTERNATORS from ½ to 675 kVA in stock, single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, generators, 1-588 kVA, all voltages. Specialists—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 140/-. See Quarterly.—Tradex, Surbiton. 170

CABLE, underground, all types ex stock.—E. M. Tatton Co., Ltd., Kew Bridge, Brentford (EALing 3155/6). 117

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists. — Batt Elecrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards. — Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS and motor-alternators, 24, 110 and 220 v. D.C. to 230/1/50 A.C., 300 watts to 6 kVA in stock.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL automatic generating plant, 110 v., 8 kW, D.C., consisting of 1 Lister 7-h.p. direct coupled to 3.5 kW and 1 8-h.p. 4.5 kW ditto. All tanks, panels, batteries, etc. Offers to—Christian & Dobbs Ltd. (Long Sutton 2374). 5640

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London. N.1. 16

EIGHT 9-h.p. totally enclosed squirrel cage motors by Crompton Parkinson for sale, A.C., 50 cycles, 415 volts, 960 r.p.m., continuous rated. These motors are available on account of a machine re-design. They have had about three hours running time only, and apart from being erected and removed the said machines are in new condition. The motors would be sold singly or as a lot. Apply—Ipswich Dock Commission, Old Custom House, Ipswich. 5592

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

FLUORESCENT fittings, lamps, starters and control gear for home and export. Fully guaranteed by actual manufacturers. Send for catalogues. — The Anglo-American Electrical Company, Olive Street, Bury, Lancs. 245

FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—The Anglo-American Electrical Company, Bury New Road, Breightmet, Bolton, Lancs. (Telephone, Bolton 7251). 212

FOR sale, motor generator, rotary converter and Ward Leonard sets in a great range of outputs, speeds and control systems.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 161

FOUR 575-h.p., 490-r.p.m., 3,000-volt, 3-phase, 50-cycle, B.T.H. squirrel cage, totally enclosed vertical motors.—A.A. Electrical Co. Ltd., 67, Rothschild Road, Chiswick Park, London, W.4 (Chiswick 5105). 5424

FREQUENCY changers and variable frequency M/A sets in stock, and to specification.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 148

GENERATING plants of all types, new and reconditioned up to 100 kVA in stock. Special plants built to order at short notice; automatic mains failure, etc. — Powerco Ltd., 312, York Rd., London S.W.18 (VAN. 5234). 151

GENERATING sets for sale, petrol, diesel and steam, from 1 kW up to 700 kW, A.C. and D.C. switchboards.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 163

HIGH frequency alternators and converters, 400 to 2,600 cycles up to 6 kVA in stock. Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 149

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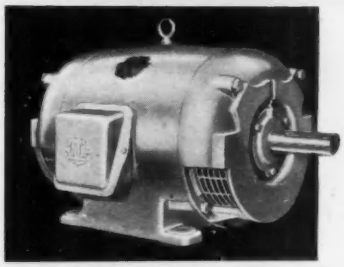

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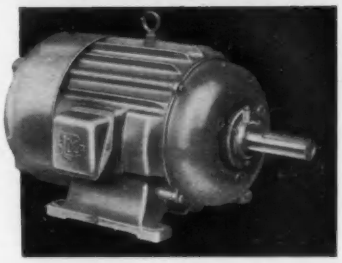

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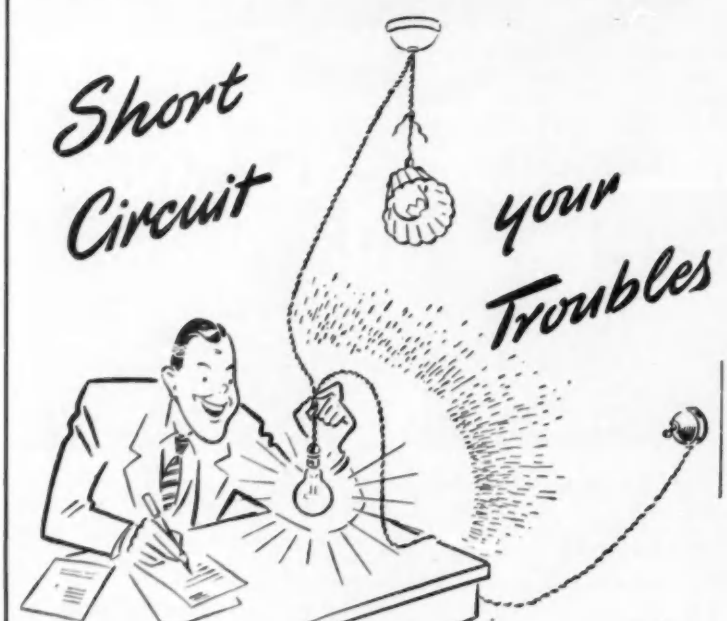

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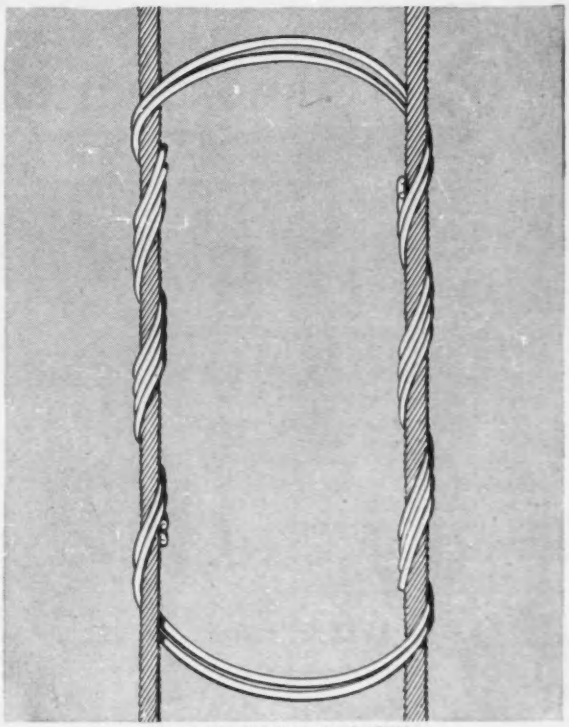

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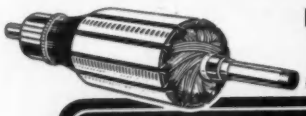

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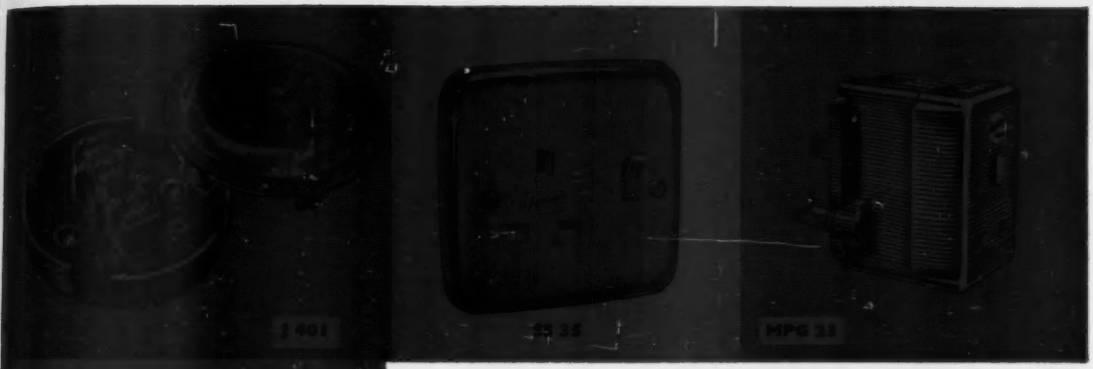

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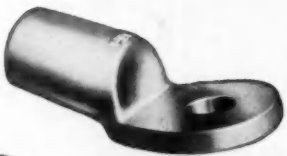
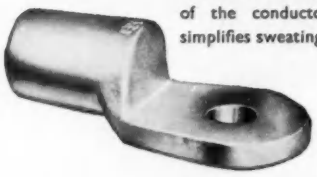
All Enquiries in connection with Electrical Distribution Equipment to:

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.,
Engineering Sales Department,
59-62 High Holborn,
London, W.C.1.

Telephone: **CHANCERY 4361**
Telegrams: **"Henletel, Holb, London"**

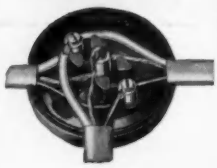




SOLDERING SOCKETS

Three patterns available, straight, right-angle and 18° angle. They are pot-tinned all over ready for use and the bell-mouthing of the conductor entry simplifies sweating.

Send for Folder 57/H



INSULATED JOINT BOXES

For wiring systems cables.

Moulded from high grade black insulating material. For use with P.V.C. insulated and sheathed, Polythene insulated and P.V.C. sheathed and T.R.S. cables.

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